MINING WORLD

September
1959

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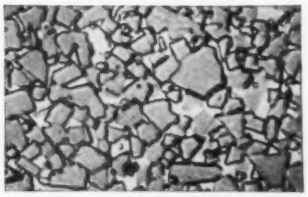
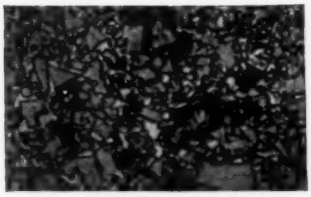


Sandvik Coromant Tungsten Carbide (Microphoto) Uniformity of size, even distribution of grain are marked. Free from porosity and impurities —therefore stronger, longer-lived.



Low quality Tungsten Carbide (Microphoto) Black marks are contaminations caused by deficient production control. They weaken the carbide, reduce its working life.

NEXT time you buy bits, specify Sandvik Coromant because they give more footage per bit, lower drilling costs. Here's why:

1 Only first-quality tungsten carbide is used —as shown in the microphotos above. This means less wear, longer life and a better job.

2 The bodies are precision-made of high quality alloy steel—tough enough to take the strain throughout the extra-long bit life.

3 The bigger Sandvik Coromant bits are all of X-design, which prevents rifling. No wonder Sandvik Coromant inserts are the most widely used in the world, drilling more than one billion feet every year.

SANDVIK COROMANT bits are supplied through Atlas Copco, the world's largest manufacturer of rock drills, who also supply Sandvik Coromant integral steels — the most widely used in the world — and Sandvik Coromant extension steel equipment.

Sandvik Coromant Detachable Bits are Available in the following Thread Sizes and Bit Diameters

Available Diameters, in Inches

Type	Thread	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2⅛	2¼	2⅜	2½	2⅝	3	3½	4	4½	5
SHOULDER	TAPER	x	x	x	x													
	F		x	x														
	113		x															
	H			x	x	x	x		x									
	115			x	x													
	D						x	x	x	x	x	x	x	x				
	K													x	x	x	x	
BOTTOMING	1" Rope				x	x	x	x		x								
	1¼" Rope						x	x	x	x		x		x				
	400						x	x		x		x						
	1½" Rope											x	x	x	x	x		
	600											x	x	x	x			
	700													x	x			
	J 7.5															x	x	
	2" Rope														x	x	x	x
	1000																x	

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1. **Control Unit signals master clutch to disengage.**
2. **Control Unit signals hydraulic system to shift transmission to neutral. Shifting collar is disengaged from present gear.**
3. **Generators notify Control Unit when transmission is synchronized for shift (shifting collar and desired gear at same RPM).**
4. **Control Unit signals hydraulic unit to shift to desired gear. Shifting collar engages new gear.**
5. **Control Unit signals master clutch to re-engage. SHIFT COMPLETE.**

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FOR TOUCH AND GO SHIFTING

Now Caterpillar research gives you an advanced new way to shift gears. Operator simply dials desired gear. Split-second shifting. Available for DW20 and DW21.

From Caterpillar's No. 1 Project* comes one of the most important earthmoving developments of recent years—*SynchroTouch Transmission Control.* This remarkable advance combines economical direct drive transmission with the easiest, fastest shifting imaginable.

SynchroTouch Transmission Control is an optional arrangement for Cat DW20 and DW21 Tractors that permits effortless shifting of transmission gears by means of a gear selector conveniently placed near the operator's right hand.

To shift up or down, the operator simply moves a selector switch to the desired gear. In less than a second it is engaged. The standard foot clutch is retained, but it is used only when starting from a standstill.

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1. Faster shifting—for faster cycles, more payloads per hour. 2. A significant reduction in operator fatigue—for higher daily production. 3. Economical direct drive transmission—uses standard DW20 and DW21 transmission and clutch components. 4. No special maintenance required.

Add SynchroTouch Transmission Control to either the new DW20 or DW21 Series G, and you have the last word in modern, high-speed, efficient earthmoving.

Both of these outstanding Caterpillar wheel-type Tractors are delivering more horsepower (345 HP), more rimpull and greater capacity than ever before. Now see them in action with the SynchroTouch Transmission Control!

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MINING WORLD

. . . including the Export Edition, WORLD MINING

Volume 21 NO. 10

September, 1959

Two New Zinc Mines for fast growing East Tennessee zinc district are foreseen by industry observers as New Jersey Zinc Company and Tennessee Coal and Iron Division of U. S. Steel each buy farms after extensive drilling 45

47.6 Tons Per Man Shift in narrow shrinkage stope enables Idarado Mining Company to operate under low metal prices. Stoping features long backs with slushing of broken rock to ore pass raises 46

Driving High Raises Without Timber is new Swedish development. The Alimank-Verken raise platform can be used in vertical or inclined raises and requires only one man to operate 52

First 100 Years of Colorado mining produces $8,000,000,000. From the gold rush of 1849 to the uranium rush of 1959 great men and great mines have made state famous. Mining has a bright future. 55

Colorado Equipment has set the standard in camps all over the world for 100 years. Colorado inventions make it easier and cheaper to find, assay, drill, blast, load, slush, and haul ore. For mineral recovery Colorado metallurgists have developed equipment to grind, pump, float, spiral, filter, and sinter ore 58

AMC Meets in Denver in mid-September. Program will feature underground and open pit mining, safety, mineral policy, management, and milling and metallurgy 65

Special Correspondent visits Union Minière du Haut Katanga in the Belgian Congo. Two new underground copper mines are being developed. Security curtain is raised slightly and he visits Shinkolobwe uranium mine, and he predicts bottom of Prince Leopold ore 69

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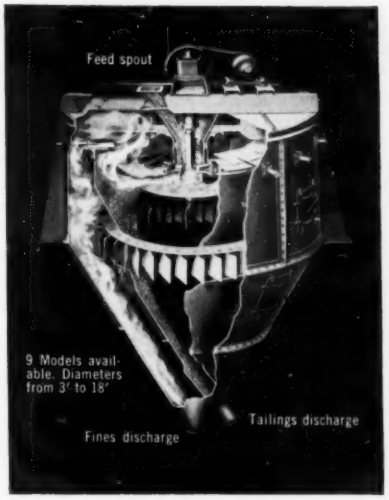
In Cement and Aggregates the Word for Air Separation is "Sturtevant"



in cement . . .

Sturtevant Air Separators make possible highly efficient closed-circuit systems. Large circulating loads increase output, eliminate overgrinding. Ball and lining life lengthens, power costs are lowered. Top quality cement results from precise control of finenesses. Standard 16 ft. Sturtevants deliver raw fines up to 70 tph, finished fines up to 260 bph.

in aggregates . . .

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We have the tools to help you solve your TOUGHEST Agitation Problems... *Profitably!*

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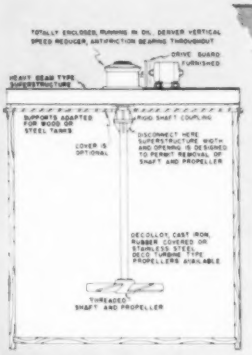
New Turbine Type Propeller Agitators have been developed up to 120" in diameter propeller size for use in large diameter tanks. This permits operation at slower speeds and at lower horsepower, yet effective agitation is obtained with pulps and slurries as coarse as 8 mesh. Special propeller blade design features eliminate cavitation, minimize wear, assure long life.

Equipped with DENVER Reducer Drive, a compact, totally-enclosed, self-lubricated speed reduction drive. Many speed selections, simple construction, easy, trouble-free maintenance.

Extensively proved in uranium mills—and for pulp suspension applications in leaching, mine backfill holding tanks and chemical processing.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DISCONNECT HERE SUPERSTRUCTURE WIDTH AND OPENING IS DESIGNED TO PERMIT REMOVAL OF SHAFT AND PROPELLER
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SIZES TO 120" AND LARGER DIAMETER

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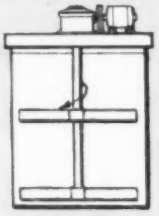
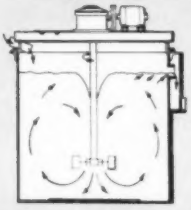


PADDLE AGITATOR

DENVER Paddle Agitators are designed for applications involving the gentle mixing of solutions or slurries containing solids of fine particle size. Equipped with DENVER vertical shaft speed reducer.

✻ DENVER Agitators for Mixing, Precipitation, Stripping



VERTICAL TURBINE AGITATOR

DENVER supplies agitators of the vertical turbine type for intimate mixing, precipitation and stripping. A complete line of worm gear drive units are available to power these impellers at correct horsepower and speed for your applications. Mixing propellers available in full range of sizes to provide desired mixing intensity.

✻ **DENVER can supply Agitators and Mixers in a full range of types and sizes . . . for conditioning, mixing, scrubbing, leaching, precipitation, aeration, etc., for either batch or continuous operation. Write for Bulletin No. A2-B4.**

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Senate Has the Answers

The lead and zinc miners, the ex-tungsten miners, the successful uranium discoverers, and the just-out-of-business cobalt miners wonder what's behind the recent United States Senate speech of Connecticut's Democratic Senator Thomas J. Dodd calling for the appointment of a New Materials Policy Commission to see that we don't run out of minerals.

This is most surprising in view of the great mineral discoveries and developments since the Original Materials Policy Commission—the Paley Commission—report was published on June 2, 1952. Viburnum, East Tennessee zinc, Ambrosia Lake, Pea Ridge, and Safford are just a few such discoveries.

The Senator does recommend that the New Commission emerge with a comprehensive program of specific legislative proposals. That will be easy. Just study the Senate Interior and Insular Affairs Committee's reports for the 85th Congress.

MINING WORLD has repeatedly pointed out that fewer commissions, and less Eastern United States misunderstanding about the mining industry are needed. Just give the miners a market for their ores so they can make some money.

These Men Set Pattern

This special Rush To The Rockies issue celebrating Colorado's first 100 years of mining would not be complete without tribute and dedication, to the many engineers and mine operators who advanced the sciences of the minerals industry for all the world to copy.

Caving in Rhodesia, gold mining in the Philippines, tunnel driving in Australia, cyaniding in Canada, and sampling in South Africa are only a few of the many examples of Colorado's engineering skill being used for the production of metals for the benefit of all mankind.

As Editor, I know that all readers will welcome, for one of the few times, some very strong personal feelings and opinions in making this tribute to some of these operators who are, unfortunately, on their last "gold" rush.

To Jack Abrams for his ability to "work with the crew" on the toughest jobs at Climax Molybdenum. Charles A. Chase, for making more low-grade ore pay than any other operator. To Ted Dickson for his metallurgical advice and counsel. Thanks, Russell Raynolds, for sharing your smelting know-how. To Joe Weston for his guidance in the vanadium-uranium districts. To Philip Argall for engineering skill, and to George O. Argall for my mining heritage.

Space limitations control the length of this list and my apologies go to my many advisors, colleagues, and friends whose names are not included on this printed page, but nevertheless form such a prominent part of Colorado mining.

These men made the pattern for all mining to follow.

G. O. A., JR.

DIAPHRAGM PUMPS
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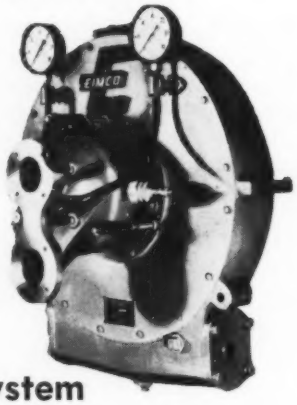
These Twin Features Give You Better Drum Filter Performance . . .

1 HY-FLOW Valve

. . . eliminates vacuum loss

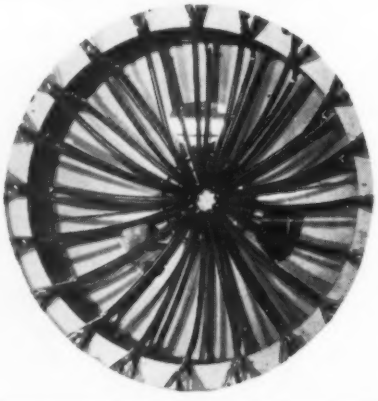


Filtrate flow is always unrestricted with Hy-Flow filter valve, developed by Eimco. This new, streamlined valve entirely eliminates all angular passages which caused troublesome turbulence and vacuum loss on flat type filter valves.

With Hy-Flow valve, drum filters operate more efficiently throughout all zones of the filtration cycle. Operators report greatly improved operating economies.

2 E-VAC System

. . . eliminates moisture in piping



Another major improvement in drum filter design, perfected by Eimco, is the E-Vac system of sweeping moisture from piping with air.

Vacuum to lead and trail pipes from each drum compartment is alternately blocked off as drum revolves. Air drawn through pipes sweeps moisture from piping system and drainage deck. No blow-back of filtrate. Result is a dryer filter cake.

The Eimco representative in your area can give you more facts on Eimco's complete line of filtration or process equipment for liquid-solids separation.

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BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD B - 423

MINING WORLD NEWSLETTER

$43,500,000 COPPER PROJECT LAUNCHED IN ARIZONA . . . American Smelting and Refining Co. has given the go-ahead for preparation and equipping of its open-pit Mission Project 15 miles southwest of Tucson. Operation is predicted on yearly tonnage of 5,400,000—exactly double output of Asarco's Silver Bell mine. Asarco recently took 25-year lease from Papago Indians for dump and tailing pond.

DISCOVERY OF AN IRON ORE DEPOSIT . . . is reported from Peru. A rough estimate of tonnage is calculated at 600,000,000 tons in positive and probable magnetite ore averaging above 60% Fe. The property is in southeastern part of Puno Dept., near Ilabe and Lake Titicaca, at elevations of 12,300 to 12,900 feet.

THORIUM GETS PLACE IN AEC . . . Long neglected only fissionable raw material other than uranium, gets big break as AEC announces long-range program to develop thermal breeder reactors. New project means major cutbacks of $94,-000,000 on fluid fuel reactor program, and estimated new allotments of $5,000,-000 to $7,000,000 for thermal program.

A $4,000,000 CREDIT TO CHILE . . . by Export-Import Bank will assist in expansion of nitrate production and its by-products. Money goes to Anglo-Lautaro Nitrate Corp. for purchase of U.S. machinery and equipment.

RESUMPTION OF FULL-SCALE MINING AND MILLING OPERATIONS . . . has been undertaken by Empire Zinc Company, subsidiary of New Jersey Zinc, at its Hanover, New Mexico properties. The operations were shut down 18 months ago because of depressed conditions in zinc industry.

40,000,000 TONS OF KAOLIN . . . have been found in Vredendal district of Union of South Africa, and deposit is not yet fully prospected! In most places, overburden is shallow, and kaolin thickness appears to be 80 feet. Nortje & Gauche are the operators.

ST. JOE RETURNS TO FIVE-DAY WEEK . . . Largest U.S. lead producer resumed production on five-day work schedule at all company mines in St. Francois Co. area of Missouri on Aug. 7. Four-day week operations had started Feb. 16. St. Joe's lead sales for first half of the year were up considerably.

A PLANT FOR MANUFACTURE OF ULTRA-PURE SILICON METAL . . . is being built by Monsanto Chemical's Inorganic Chemicals Division near St. Louis, Missouri. The company has been running pilot units for some time; hopes to have new plant operating at design capacity next year.

U.S. TARIFF COMMISSION . . . will review situation on imports of manufactured lead-zinc products which are outside present quotas. Increase in these imports is said to make quotas on unmanufactured lead-zinc ineffective.

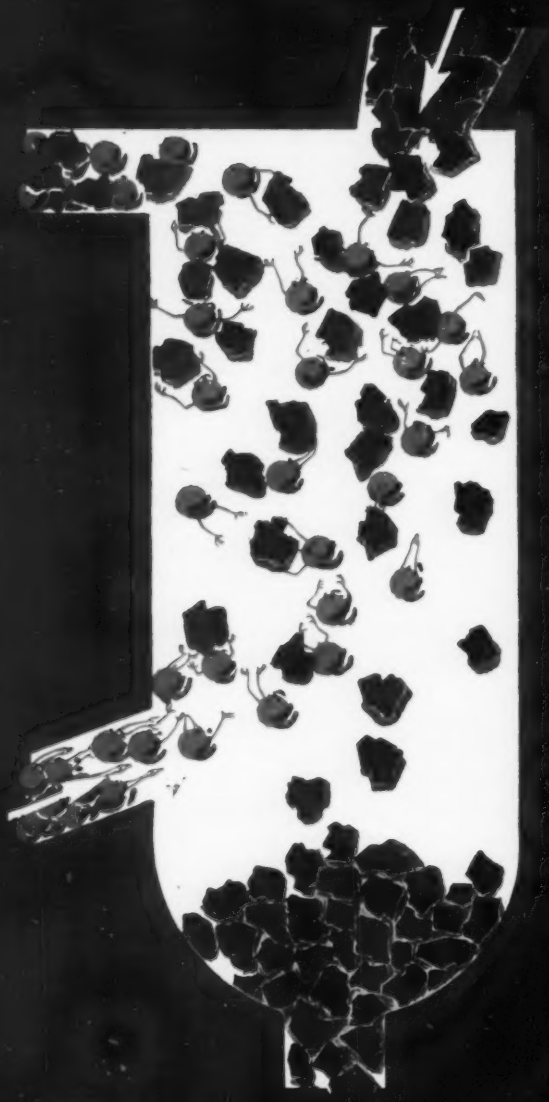
AEC INVITES PROPOSALS FOR SMALL SIZE NUCLEAR POWER PLANT . . . Construction is to start around May 1960, with completion in May 1962. Submit proposals by November 16 of this year to Oak Ridge, Tennessee office, PO Box "E".

UNION CARBIDE TO PRODUCE HIGH-PURITY TUNGSTEN COMPOUND . . . Expanding plant at Bishop, Calif. to provide first direct method for preparing high-purity ammonium paratungstate from scheelite. Bishop operations will now be completely integrated from mine to refinery.

NAVY AWARDS TANTALUM RESEARCH CONTRACT . . . National Research Corp. to develop tantalum and tantalum-tungsten alloys as strong erosion-resistant materials for use in rocket propulsion systems.

KNAPSACK-FERROSILICON 15% ATOMIZED

FOR HEAVY MEDIA SEPARATION



Helps reduce costs and increases operating efficiency by:

1. **Reducing corrosion**

   The spherical shaped particles of atomized ferrosilicon offer maximum resistance to corrosion due to their smooth, hard surface. There are no sharp-edged corners which are particularly susceptible to rusting.

2. **Reducing „drag-out" or adhesion losses**

   Atomized ferrosilicon particles are easily separated from the ore and gangue by spraying on the rinsing screens, eliminating high losses due to adhesion.

3. **Reducing pulp viscosity**

   The ball-to-ball contact of the atomized ferrosilicon particles minimizes mutual adhesion, reducing the pulp viscosity.

   Because of the reduced pulp viscosity, the feed can be increased to give a more dense pulp for sharper separations. Specific gravities up to 3.9 are attainable.

4. **Reducing wear on equipment**

   Atomized ferrosilicon, due to its rounded surface, materially reduces wear on pumps, piping, etc.

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South Africa, and deposit is not yet

for use in rocket propulsion systems.

CAPITOL CONCENTRATES

Reorganization Dangerous To Mining

A recent reorganization plan offered to the Congress presents a real danger to the mining industry. The plan would transfer many mineral functions from the Department of the Interior to the Department of Agriculture, where there would be even less sympathy for claim locators, owners, or lessees.

When the President sends one of these plans to the Congress, the Committees on Government Operations, the House and the Senate have 60 days in which to either approve or disapprove the proposals. (They may not modify.) The House committee has disapproved the plan as being unfair to the minerals industry and it is quite likely that the House will follow suit. In place of the plan, H. R. 7681 has been introduced to accomplish some of the features of the plan and to eliminate the dangerous ones.

SEC Adopts Assessable Stock Rule

The Securities and Exchange Commission, on July 30, 1959, announced the adoption of certain rule changes relative to assessable stock. These changes, which become effective September 1, 1959, make it clear that the levying of assessments on assessable stock involves the offering and sale of securities within the meaning of the Securities Act of 1933.

The new Rule 136 defines the term "offer," "offer to sell," "offer for sale" and "sale" to include specifically the levying of assessments on assessable stock. It also provides that the offer or sale of assessable stock at public auction or otherwise to realize the amount of an unpaid assessment thereon is not exempt from the Act as a transaction by a person other than the issuer. An amendment to Rule 140 was adopted to make it clear that it applies to the levying of assessments, as well as to other types of offers and sales. A new exemption regulation (designated Regulation F) provides a conditional exemption from registration for assessments and for securities sold at delinquent assessment sales.

Chairman Gadsby of the SEC, commenting upon the new regulations for assessable stock companies, stated:

"The only information which a company would be required to send its stockholders, or otherwise publish, would be a statement of the purposes for which the proceeds from the assessment are proposed to be used. This information could be included in the notice of assessment given by mail or otherwise published as required by state law. If the issuer should employ any other sales literature copies would be required to be filed with the commission."

There is no doubt that the original idea of assessable stocks, at least in mining, was a convenient device to raise the necessary money to do more development work, build a mill, etc. The idea of using the assessment money to invest in new businesses appears to be a quite modern development.

As explained by the SEC: "Some companies appear to be operated largely, if not solely, for the personal benefit of insiders. In some instances, it has been indicated that companies having assessable stock outstanding are being used for raising funds for other companies which are unable or unwilling to seek funds directly from the public;" and "the payment of an assessment is the making of a new investment in the company and such an investment cannot be made intelligently unless it is made upon the basis of reasonably adequate and accurate information."

Now that SEC has formally adopted the new regulations, the only recourse open to those who objected to the changes is to carry their case to the federal courts.

Does President Have Legal Authority?

There is a strong feeling that the President may not have the legal authority to modify his Executive Order on lead and zinc quotas without another review by the Tariff Commission. If this proves to be the case, one may look forward to a Congressional resolution ordering the commission to make such a review with emphasis upon the semi-finished and finished-product import angle. What the President may do about it is mere conjecture.

Congressmen Fail To Aid Manganese

The Western Senators and Representatives worked manfully, but unsuccessfully, to keep the domestic manganese industry operating, against the close-down deadline of August 5, 1959.

The government has refused to O.K. legislation to extend the program. Also, the representative of the Office of Civil and Defense Mobilization warned the Senate Appropriations Committee that, even if funds were appropriated to extend the program, OCDM would not spend the money for that purpose without a definite Congressional authorization or directive forcing the agency to do so. Background for the warning was the fact that some 22 western Senators petitioned Senator Carl Hayden, chairman of the Senate Appropriations Committee, to include $23,000,000 to extend the carlot program by 10,000,000 long ton dry units.

Even if this was done, there remained the hurdle of the House members of a Conference Committee going along, as the House Appropriations Committee provided no money for this purpose. If the Conference Committee went along with the deal, there also remained the hazard of some economy minded Senator or Representative knocking the item out on the Floor of the House or Senate, especially on the basis that the Administration has testified that it does not want the manganese.

Truly, the lot of the mining industry in this Administration and this Congress is not a happy one!

Get Report On Aspinall Resolution

Anyone interested in mining should write to the Interior and Insular Affairs Committee of the House of Representatives for House Report No. 708 on the Aspinall resolution, H. Con. Res. 177. The title of the report is "Declaring the sense of Congress on the depressed domestic and mineral industries affecting public and other lands."

What the effect upon government mining policies may

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be is another matter. The reactions of interested government agencies varied from about neutral to viciously adverse, as may be seen from the agency comments which are printed. Also, all the mechanisms by which the government has acquired minerals are described in detail with comments, as well as the various relief procedures provided by law, which seldom seem to work.

One of the most pertinent and cogent quotes in the report reads as follows: "Given adequate incentives, our known mineral resources tend to increase, not diminish. Lacking suitable incentives, our mines will close, exploration will stop, and the remaining reserves in many areas will become inaccessible." This statement is a splendid argument against the "have-not theorists" with whom domestic mining has had to contend for years.

It must be remembered that a concurrent resolution, even if passed by both Houses of the Congress, is merely suggestive of the temper of the Congress, and is not signed by the President. Even if passed, therefore, H. Con. Res. 177 will not have the force of law and the Administration can, if it wishes, completely ignore it.

How Ridiculous Can A Definition Get?

Here is a decision by the United States Forest Service defining "discovery":

"A discovery within the meaning of the mining laws, of a material of widespread occurrence, is established when it is shown that the deposit can be extracted, removed and marketed at a profit." (Contest 9866.)

A forest ranger prohibits you from working or even going onto a mining claim until you have made a legal discovery, and yet they expect you to show that the material can be "extracted, removed and marketed at a profit!" If you try to do that, you probably will be arrested for trespassing.

The above decision is about as bad as the recent declaration that a manganese producer's mining claim was invalid on the grounds that the manganese program would be completed in September and the producer could no longer ship his rock and make a profit, though he had made regular shipments under the carlot program. Therefore, the claim would no longer be a valid one since the locator could not show discovery under the definition now being used.

One wonders how this word "profit" ever got into the picture. There is nothing in the laws, or the court decisions interpreting the public land laws, which requires the claim owner to demonstrate profitable operations. Once upon a time, as we recall, there were many court decisions saying something about "a prudent man."

COMING CONVENTIONS

September 14 through 17. Annual convention WESTERN DIVISION AMERICAN MINING CONGRESS, Brown Palace Hotel, Denver, Colorado.

October 4 through 10. The 26th INTERNATIONAL FOUNDRY CONGRESS, sponsored by the Instituto Del Hiero y Del Acero and the Higher Council for Scientific Research Spain, Madrid, Spain.

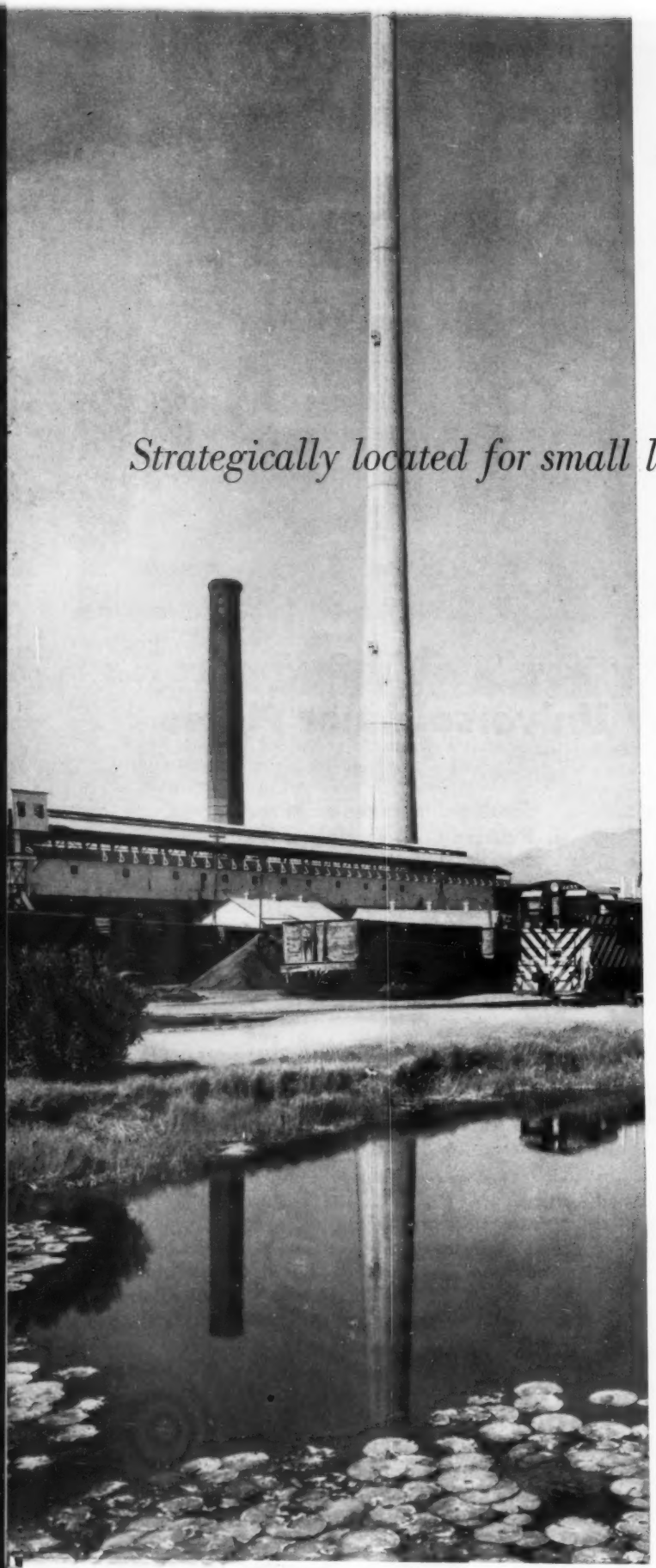
October 7, 8, 9. Sixth NATIONAL SYMPOSIUM ON VACUUM TECHNOLOGY, sponsored by the American Vacuum Society, Sheraton Hotel, Philadelphia, Pennsylvania.

October 8, 9, and 10. Ninth annual DRILLING SYMPOSIUM sponsored by the Pennsylvania State University, Colorado School of Mines, and University of Minnesota. Continuing Education Conference Center, University Park, Pennsylvania.

October 12, 13, and 14. Eighth NATIONAL CLAY CONFERENCE, University of Oklahoma, Norman, Oklahoma.

October 19 through 22. Mining section of the NATIONAL SAFETY CONGRESS, Chicago, Illinois.

October 28 through 31. INTERNATIONAL MINING DAYS and annual convention of the NEW MEXICO MINING ASSOCIATION, Paso del Norte hotel, El Paso, Texas.



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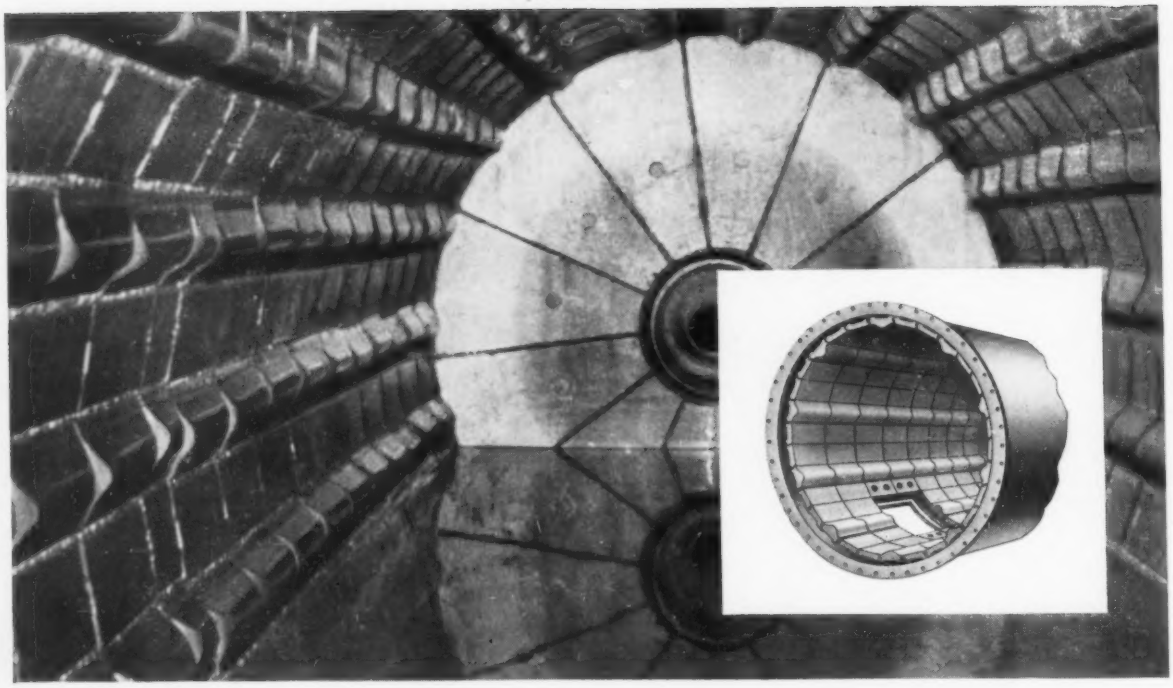

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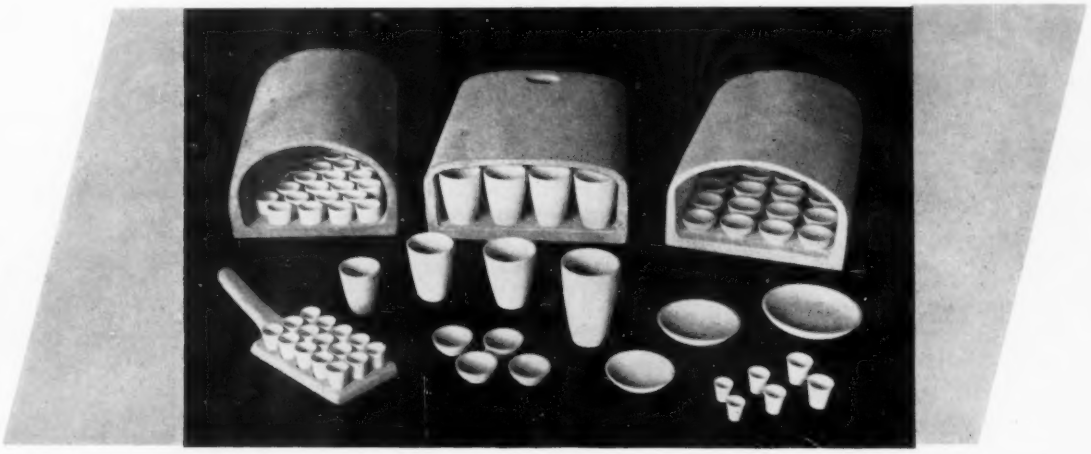

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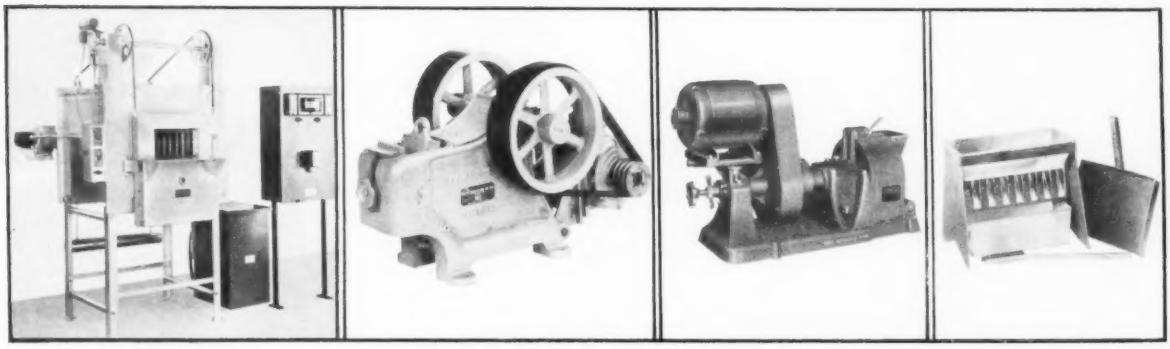

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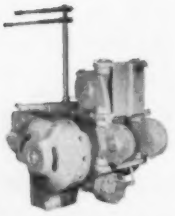

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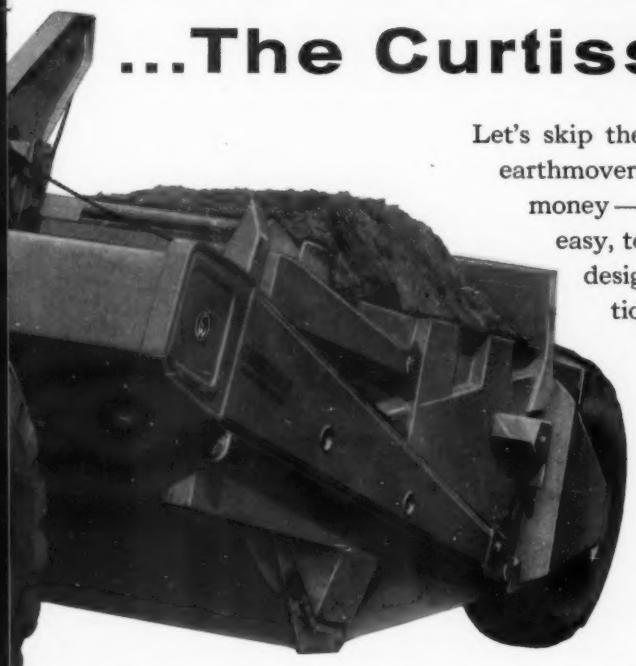

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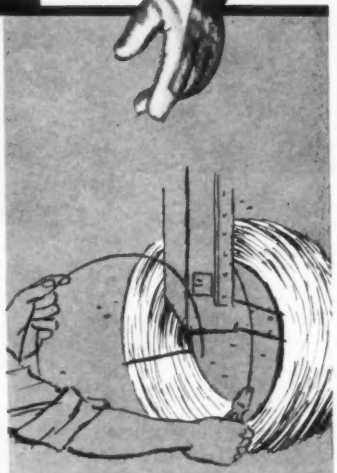

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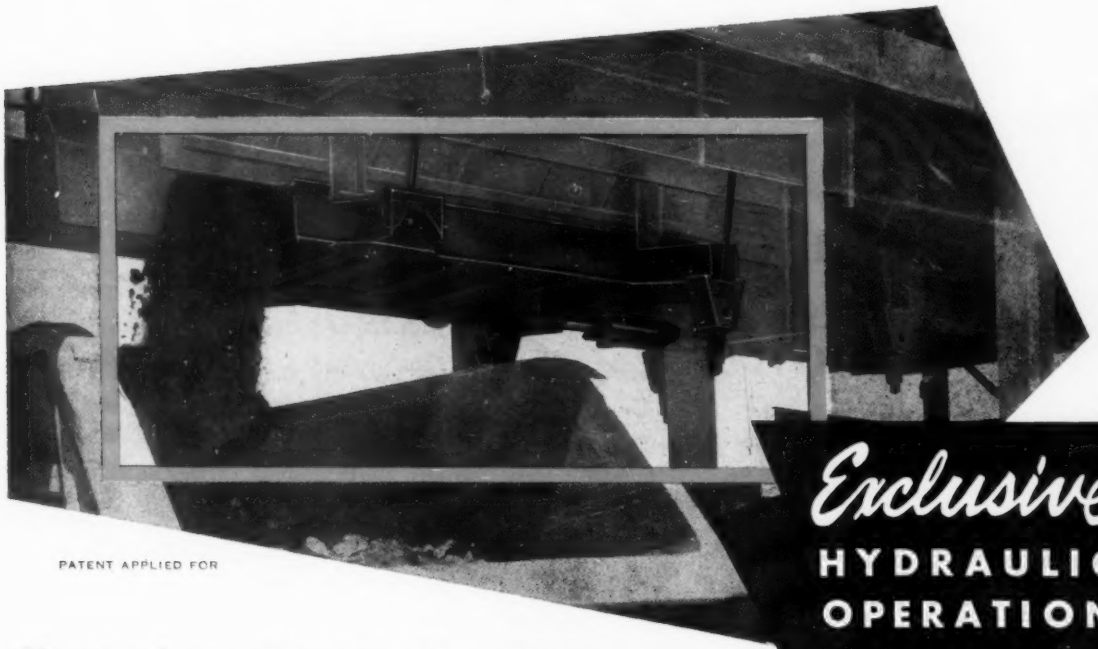

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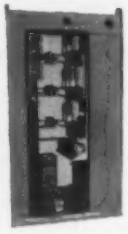
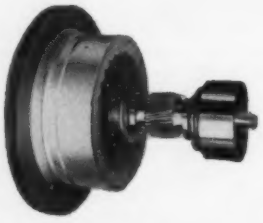
P&H has always been the pioneer developer of dramatic new designs and processes—this is why P&H Electric Shovels incorporate design fundamentals which make them different from all others. By their pioneering, P&H found "the better way" to production premiums as high as 10%, lower unit cost and more net profit for P&H owners.

Some exclusive P&H design fundamentals not found in other electric shovels are:



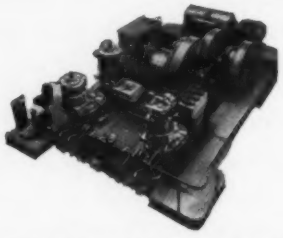
1. ELECTRONIC CONTROL

This patented P&H control accomplishes the quickest work motion reaction time known for electric shovels. Control maintenance expense is reduced as much as 80% by elimination of all moving parts for a completely closed circuit system.



2. MAGNETORQUE® HOIST DRIVE

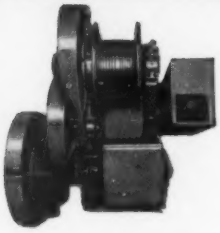
This patented hoist drive electro-magnetically transmits the full digging power of an A.C. motor direct to the dipper without motor generator set conversion to D.C. current! It gives up to 30% higher bail pull for more uniform digging speed and greater dipper fill factor.

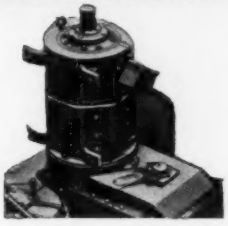


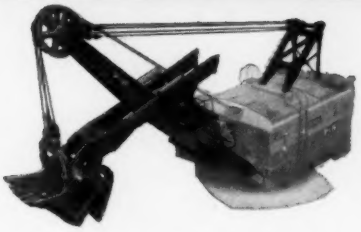
3. FULL WELDED STEEL CONSTRUCTION

P&H was the originator of electric shovel construction by the unit welded rolled steel method. Their accumulated wealth of experience pays P&H owner dividends in the form of exceptional long shovel life in hard digging—accomplished by full welded steel construction.

"P&H is now the world's largest builder of full-electric and diesel-electric shovels. Only P&H manufactures their own electrical as well as mechanical components—designed specifically for electric shovel service—gives you the service assurance of single source responsibility."







4. ENCLOSED HOIST MACHINERY

Only on the P&H Shovel is all deck machinery—the power trains for hoist, swing and propel drives—enclosed in oil tight gear cases. No open gearings! Modern power train design at its best!

5. INDEPENDENT CRAWLER PROPEL MOTOR

Only P&H Electric Shovels have an independently motored crawler propel drive. P&H gives shovel owners the advantages of independent motoring—the basic principle of electric shovel design and purpose. The P&H is FULL-ELECTRIC in every work motion.

6. T-1 STEEL ... SHOVEL ATTACHMENT

Only P&H furnishes as standard a boom and dipper handle fabricated of ultra high strength T-1 steel for high impact absorption ability, especially important in sub-zero temperatures. P&H pioneered and is the most extensive user of rolled alloy steels.

P&H MINING EXCAVATORS

OUR 75TH YEAR

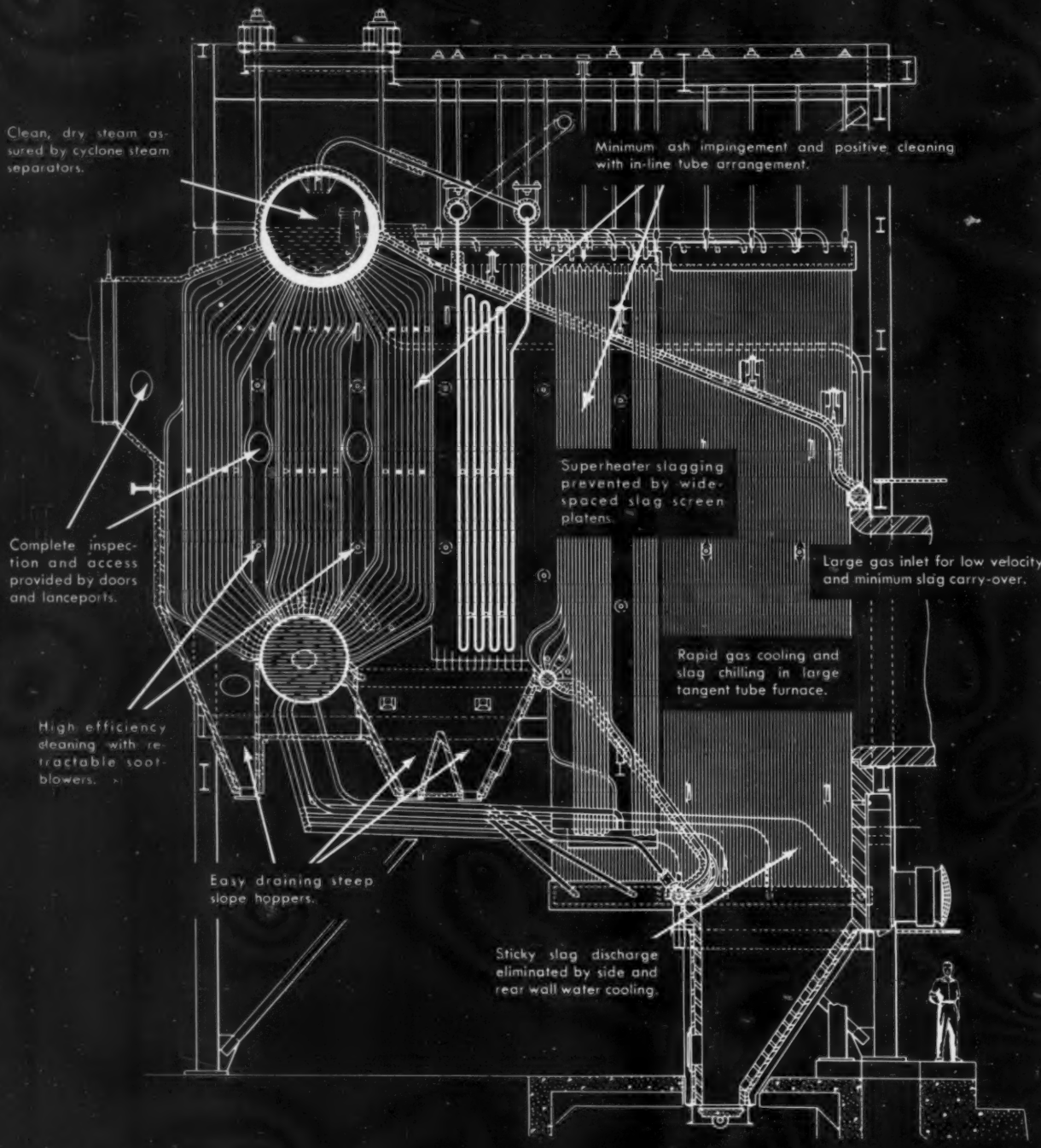
HARNISCHFEGER CORPORATION • Construction & Mining Division • Milwaukee 46, Wisconsin

P&H LINE

Full-Electric and Diesel-Electric Shovels & Draglines: 3½ through 10 yds.

Diesel Excavators: ½ through 3½ yds.

Truck Cranes: 10 through 80 tons


Clean, dry steam assured by cyclone steam separators.
Minimum ash impingement and positive cleaning with in-line tube arrangement.
Superheater slagging prevented by wide-spaced slag screen platens.
Complete inspection and access provided by doors and lanceports.
Large gas inlet for low velocity and minimum slag carry-over.
Rapid gas cooling and slag chilling in large tangent tube furnace.
High efficiency cleaning with retractable soot-blowers.
Easy draining steep slope hoppers.
Sticky slag discharge eliminated by side and rear wall water cooling.

These important design features assure trouble-free, continuous operation of this B&W Waste Heat Boiler

Empresa Nacional de Fundiciones, Paipote, Chile, uses this B&W Waste Heat Recovery Boiler to produce 42,500 lb steam per hour at 400 psig and 700 F at the superheater outlet.

HOW TO SOLVE WASTE HEAT BOILER PROBLEMS

B&W heat recovery system ends production bottleneck

A major problem in waste heat boiler operation is the fouling of steam generating surfaces by slag and ash from the process. Frequent outages and excessive labor for boiler cleaning add substantially to the cost of any plant operation. Production delays can result in further serious losses.

For example, the Empresa Nacional de Fundiciones copper smelter at Paipote, Chile was experiencing difficulty in handling high temperature corrosive gases with considerable slag and metallics carryover. Slagging of boiler surfaces was severely limiting plant production. Unscheduled smelter shutdowns resulted in excessive refractory maintenance, high operating costs, and production losses.

B&W's engineers were asked to design a boiler to provide trouble-free operation for these difficult ash and slag conditions. An important requirement was that the new system be installed without interrupting plant operation. Utilizing the extensive experience gained from similar installations, B&W recommended a special, single pass, low draft loss boiler for the specific plant conditions at Paipote. B&W's recommendations for a completely engineered system were accepted and a waste heat boiler, flues, dust handling equipment, and auxiliaries were furnished.

The successful elimination of the waste heat handling problems, previously limiting production and causing high maintenance costs, has now been proved by several months of operation. In fact, plant production is now above design capacity.

B&W's extensive research and engineering facilities, plus its broad field experience in design and operating requirements in the metallurgical process industry, are available to solve your problems. The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

Send for this Free Definitive Bulletin — G-88 — Today

ME-100

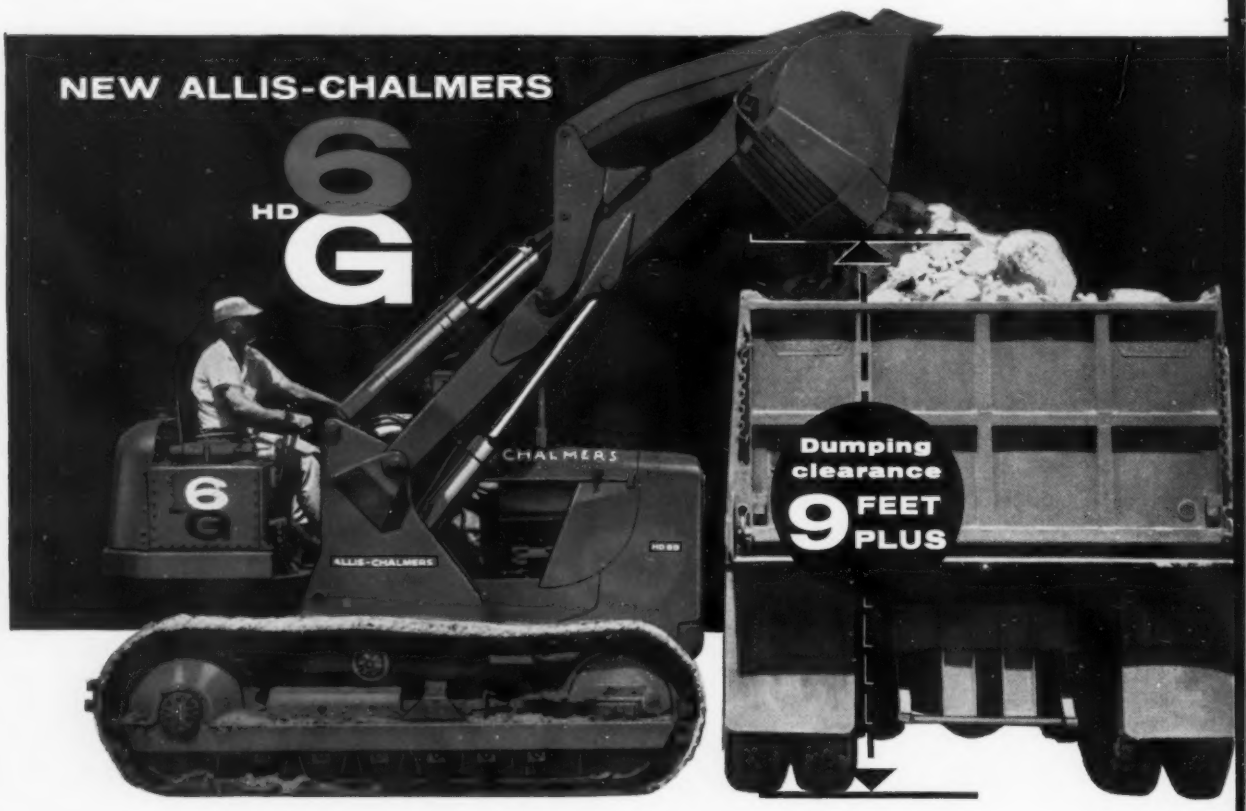
B&W

THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

new slant in tractor shovels . . . everything you need for

BIG PRODUCTION AT



What you want most in a 1½-yd tractor shovel is here. The new 6G gives you advanced-design features that mean extra productive ability you can *measure*—plus new comfort and convenience for the operator, servicing simplicity and big-tractor strength.

But this is only half the story. Your Allis-Chalmers dealer can tell you much, much more—and *prove* it, too! Why not let him set up a demonstration *now*, on your tractor shovel job? Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

Height with a bonus in reach

With as much as a foot more dumping height than the maximum for ordinary tractor shovels, the 6G reaches 'way out to dump over the center of big, sideboarded, 12-yd trucks. This height-and-reach combination pays off on other jobs, too—like stockpiling or loading out over the sides of excavations.

move ahead with ALLIS-CHALMERS AC . .

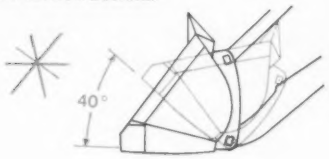
LOW COST

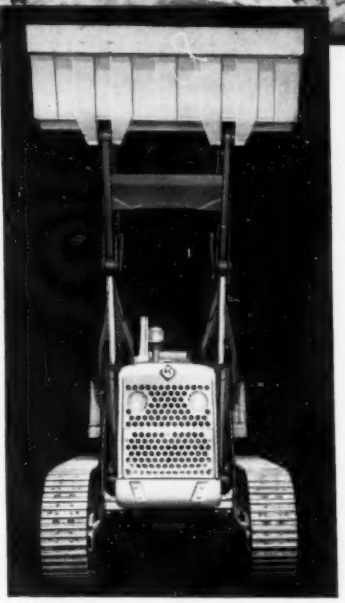
- 72 net engine hp
- 21,000 lb
- 1½-yd general purpose bucket
- 40° bucket tip-back
- Fast reverse to 4.1 mph
- Rugged "in-line" booms and linkage
- Best dump height, reach in its class

Super pry-out action

The new 6G's curved-bottom bucket puts a 10¾-ton force at the cutting edge. This unique "rolling-leverage" action is far more effective than the fixed, toe-and-heel principle of an ordinary, shoe-type bucket bottom. You can break out stubborn boulders, stumps and old pavement easily—get *full* loads *fast* in hardest materials.

Bucket tips back 40° on curved, box-section bottom.





Speed with stability and control

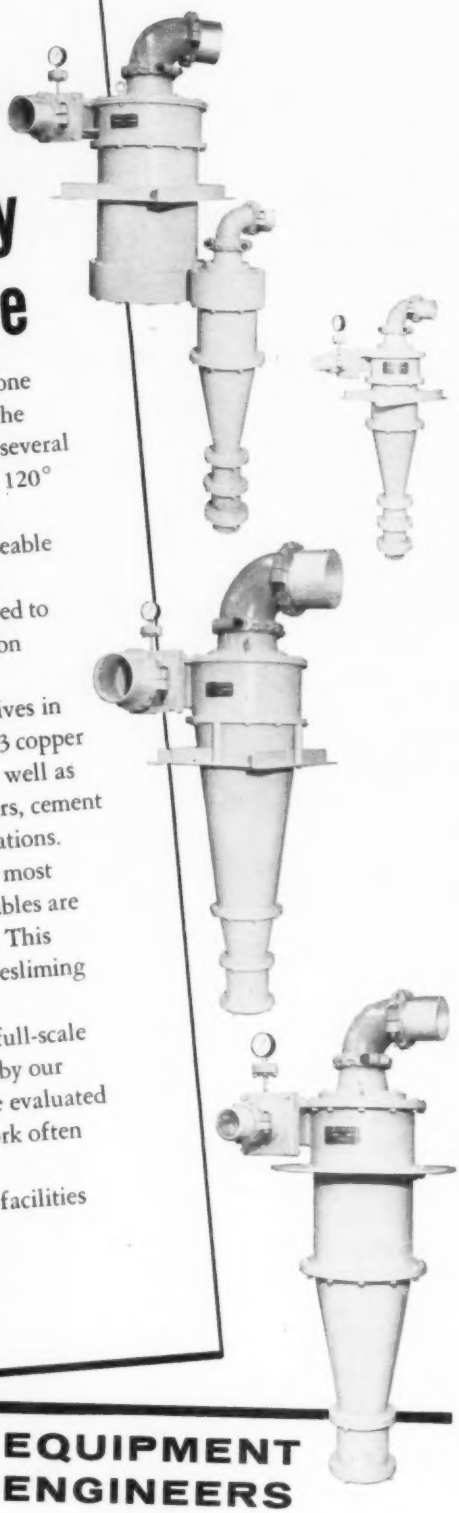
Shift from any forward speed to either reverse speed with a single lever—choose the *right* speed for every tractor shovel function. Powerful hydraulics put big loads right to the top, then bring the bucket down in a smooth, swift cycle. Nearly seven feet of track on the ground . . . positive, accurate controls . . . and new "down-slope" visibility let you handle the bucket and tractor with unheard-of balance and precision.

"In-line" strength

Booms and linkage are twin towers of solid-steel strength, straddle-mounted on wide-spaced pivots in the double-walled side frames. Lift and dump cylinders operate in exactly the same line, put dependable hydraulic power to work *straight from the shoulder*.

. . . power for a growing world

KREBS CYCLONES ...20 models for every classification objective



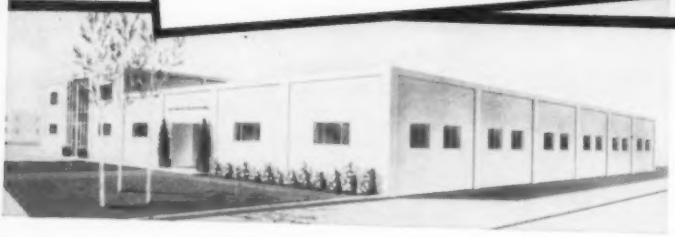
Equipment Engineers Inc. are specialists in cyclone techniques. Ten years of effort concentrated solely on the design and manufacture of cyclones has resulted in several new and vital concepts of dynamic classification. The 120° involuted sweep entry of all Krebs Cyclones increases capacity and performance. The Krebs molded replaceable pure gum rubber liners are still operating as original equipment in 90% of all Krebs Cyclones manufactured to date—hundreds having handled more than a million tons each.

Krebs Cyclones cover a wide range of objectives in extremely diverse fields. There are installations at 43 copper concentrators, 21 iron plants, 22 uranium plants as well as lead-zinc and gold-silver mills, glass sand producers, cement plants, and scores of other industrial mineral operations.

The hydrocyclone, properly designed, is the most potent of all classifiers . . . but only when all variables are correctly correlated to the classification objective. This applies to closed circuit grinding to 20 mesh or desliming to —10 microns.

Our Palo Alto Pilot Plant is equipped for full-scale classifications. Analyses of test results are made by our staff of metallurgical engineers and the data are evaluated on the basis of over-all plant operation. This work often leads to economies and metallurgical gains.

You are invited to avail yourself of these facilities for the study of your classification problems.



EQUIPMENT ENGINEERS INC.

737 Loma Verde Avenue • Palo Alto
California

No. 15 in a series

Right off the Wire

42. A 150-watt lamp only three and one-half inches high is said to give a screen brilliance in a movie projector equal to that of a 750-watt lamp.

43. A new electron tube that will go inside a thimble is being made to compete with the transistor.

44. Rustproof hub caps for automobiles are being made of fiberglass.

45. Bulbs can be installed in a new electric light fixture with only a quarter of a turn.

46. An inexpensive attachment for any radio sounds an audible warning if radioactive fall-out reaches a dangerous level.

47. A giant earth mover, driven by an electric motor in each of its eight wheels can scoop up a fifty-ton load in less than two minutes.

48. Ultrasonic energy, used in machining hard or brittle metals, can now be transmitted around corners.

49. A research camera with 1,200 lenses can take pictures at the rate of 42,000 per second.

50. A new diesel-electric locomotive can be switched to third-rail operation without stopping.

51. Electric automobiles are in production again. Range on a charge is eighty miles.

52. A miniature TV system made for use in a missile weighs only nine pounds and has a range of 1,000 miles.

53. Maximum spark at all engine speeds is claimed for a new transistorized ignition system for internal combustion engines.

54. The first telescope in space is in the plan stage. It would map the sky in ultraviolet light which is blocked by the earth's atmosphere and would be supported by an unmanned orbiting vehicle.

55. A proposed atom smasher would be two miles long and eight times more powerful than any now in existence.

56. Paraplegics may use a new typewriter in which photoelectric cells are substituted for keys. A lamp on the user's head actuates the cells.

Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.

57. Aluminum shingles are now being made in a variety of permanent baked enamel colors.

58. A new helicopter can carry six tons of cargo.

59. A system of harnessing helicopters in teams by the use of metal spreaders has been developed.

60. An electric drink mixer that can be used anywhere operates on flashlight batteries.

61. A dentist has invented a toothbrush powered by an electric motor.

62. The successor to the "Jeep" is a new 1,700-pound vehicle powered by an aluminum, air-cooled V-4 engine.

63. A New York Bank has installed a clock, powered by a radioisotope, that will run for 200 years without winding.

64. Interchangeable tips for pliers make one tool serve many purposes.

65. The Air Force has discovered that submerging a man in water doubles his resistance to acceleration.

66. A new Army rifle is replacing the Garand. It holds twenty cartridges which can be fired at the rate of twelve and one-half a second.

67. Plate glass floated on the surface of molten metal is said to have a better finish than that produced by grinding and polishing.

A NEW MINE—
UNDER 50′ OF WATER!

Seven miles off the coast of Louisiana, Freeport Sulphur Co. is completing the world's first offshore sulphur mining plant. This unique engineering project consists of a Y-shaped steel island nearly one mile long (the world's largest) erected over a major new sulphur deposit known as Grand Isle.

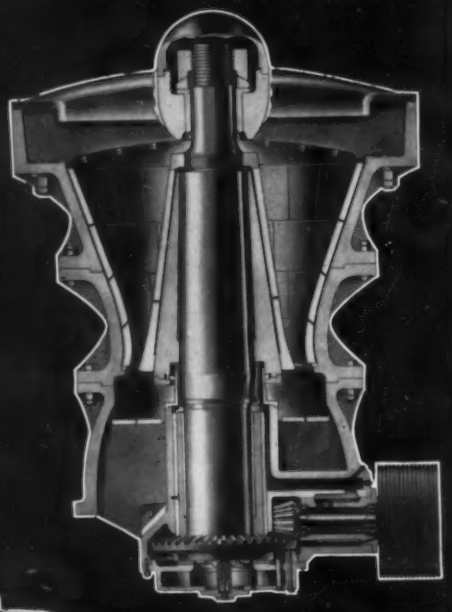
Supplying power to the drilling platforms and other machinery are Simplex ANHYDREX XX insulated Submarine Power Cables. With a background of forty years' service to the mining industry, Simplex is proud to have contributed to this pioneering project.

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

Highest quality cables for: Mining
Power & Lighting • Construction
Transportation • Communications
Signalling

TC GYRATORY CRUSHERS



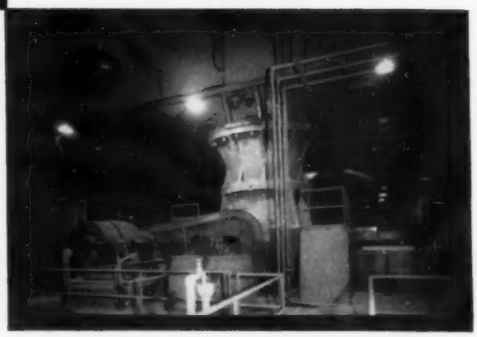
Traylor-made for primary reduction

Traylor engineers are the world's largest builder of giant 60" Gyratory Crushers. Here are some of the reasons the Traylor TC Gyratory Crusher is so much in demand:

- A straight line bar type spider, of heavy construction—simple but strong.
- Traylor original, self-tightening, bell head and curved concaves.
- The Traylor patented dust seal. A practical and efficient device for excluding foreign matter from the lubrication chamber.
- A positive outside automatic lubrication system.
- Bronze bushed eccentric bearing with pressurized lubrication.

. . . made in 7 sizes with feed openings 20" to 60" and capacities from 1,240 to over 32,000 tons per eight hour day are in use by many leading producers throughout the world.

For specifications and capacities, send for Traylor Bulletin No. 1126.



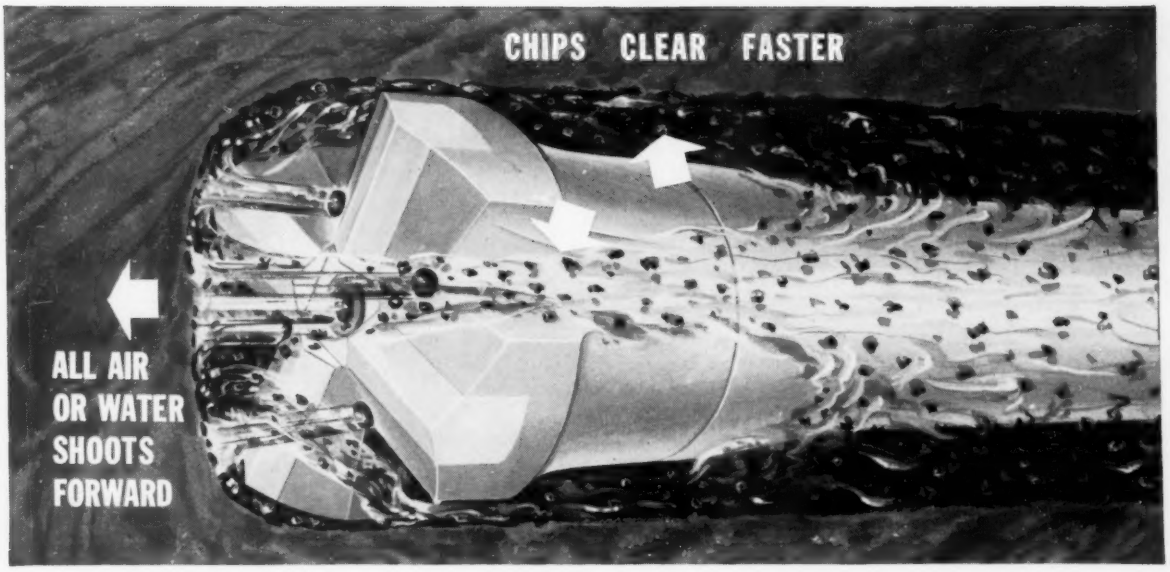
Shown above a 54" TC Gyratory Crusher in a portland cement plant.

GYRATORY CRUSHERS • JAW CRUSHERS
Traylor
ROTARY KILNS • BALL MILLS • APRON FEEDERS

See the Traylor Display at the Chem Show
Booth No. 495
New York Coliseum Nov. 30 to Dec. 4

TRAYLOR ENGINEERING & MFG. CO., 1192 MILL ST., ALLENTOWN, PA.

Sales Offices: New York — Chicago — San Francisco
Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P. Q.



How the TIMKEN® threaded bit cuts drilling costs on drifters, sinkers and stopers

SPEED DRILLING and cut bit costs with these Timken threaded bit features. 1) Five front holes and 2) wider wing clearance speed chip removal; and 3) wear-resistant carbides give longer bit life.

The action picture above shows how you can cut drilling costs on drifters, sinkers and stopers. The Timken® threaded carbide bit drills more hole-per-bit because two features clear chips faster. 1) Five front holes shoot air or water *directly* against the rock face: and 2) deeper, wider wing clearance lets chips wash back faster. Deeper relief under the heel provides an even freer passage. As a result, the bit spends less time "drilling" chips, more time drilling rock. And removing chips this faster, more economical way eliminates the problem of clogged drill steels, prevents damage to bit skirts.

What's more, the Timken threaded bit has special analysis carbides that give increased resistance to wear and shock. They can be reconditioned many times. And improved thread contact reduces breakage to a minimum.

To get more hole-per-bit, use the Timken threaded carbide bit. For more cost-saving details, send for free brochure. The Timken Roller Bearing Company, Rock Bit Div., Canton 6, Ohio. Cable address: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.*

USE THESE TIMKEN BITS FOR OTHER TOUGH DRILLING JOBS

IMPROVED TIMKEN ALL-STEEL MULTI-USE BIT

With correct, controlled reconditioning, gives lowest cost per foot-of-hole when full increments of steel are used.

THE AIR-LEG BIT OF THE FUTURE

The Timken tapered socket bit is removable for full steel life yet tapered for one-piece strength. Same frontal features as threaded bit.

TIMKEN® REMOVABLE ROCK BITS

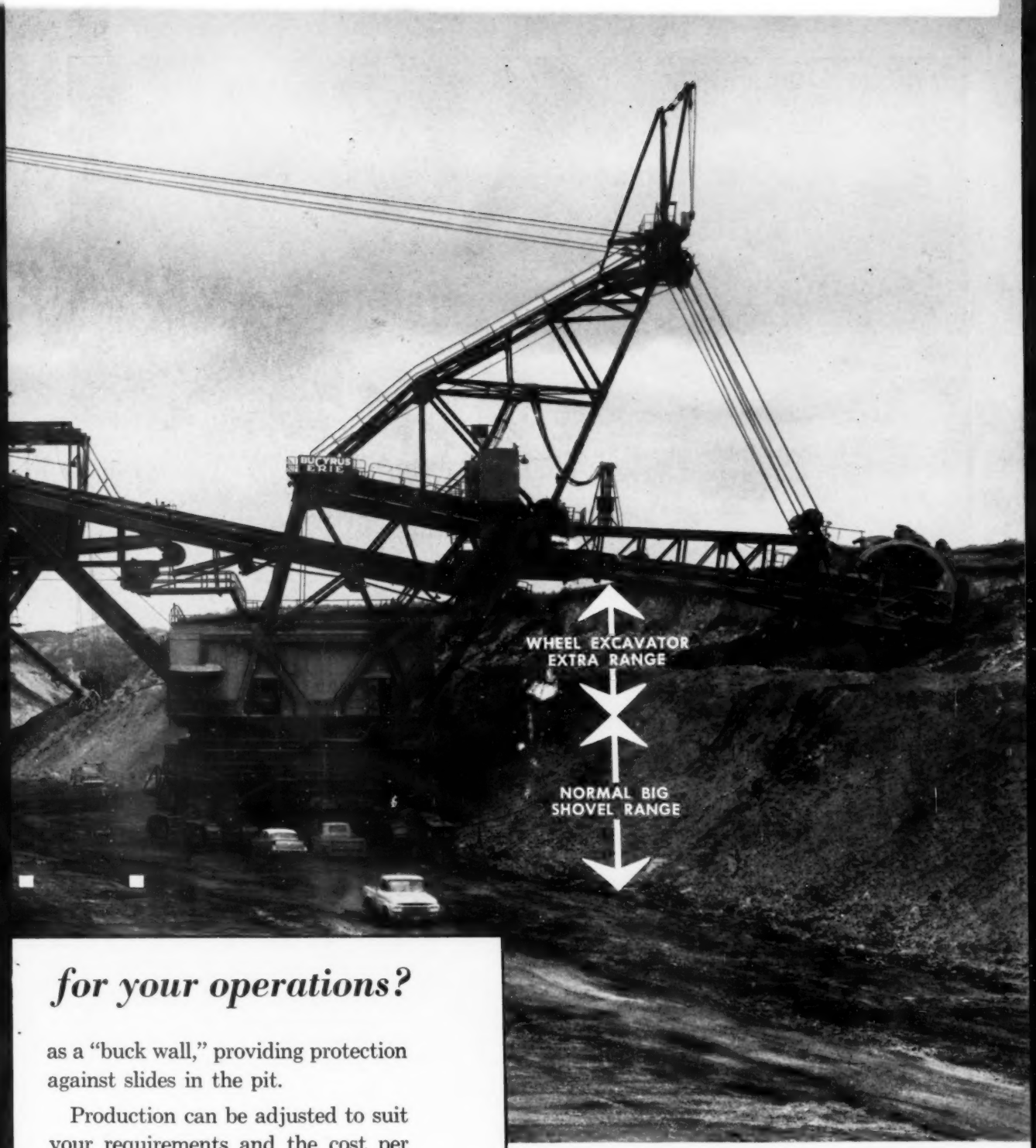
MEET THE WHEEL EXCAVATOR .

. . . have you considered this revolutionary machine

Take a close look at the unique abilities of the Bucyrus-Erie wheel excavator. Perhaps it is the answer to your large-scale excavating, stripping and high-volume dirt-moving problems.

In the coal fields for example, Bucyrus-Erie wheel excavators team up with present big shovels and make it possible to uncover veins previously too deep for practical stripping . . . thereby increasing strippable reserves and extending the use of present equipment.

The "wheel" can deposit the unstable material, normally occurring near the top of a mine cut bank, far back onto the spoil pile. The stripping shovel places the more stable material from the lower part of the bank at the bottom of the spoil pile where it acts



for your operations?

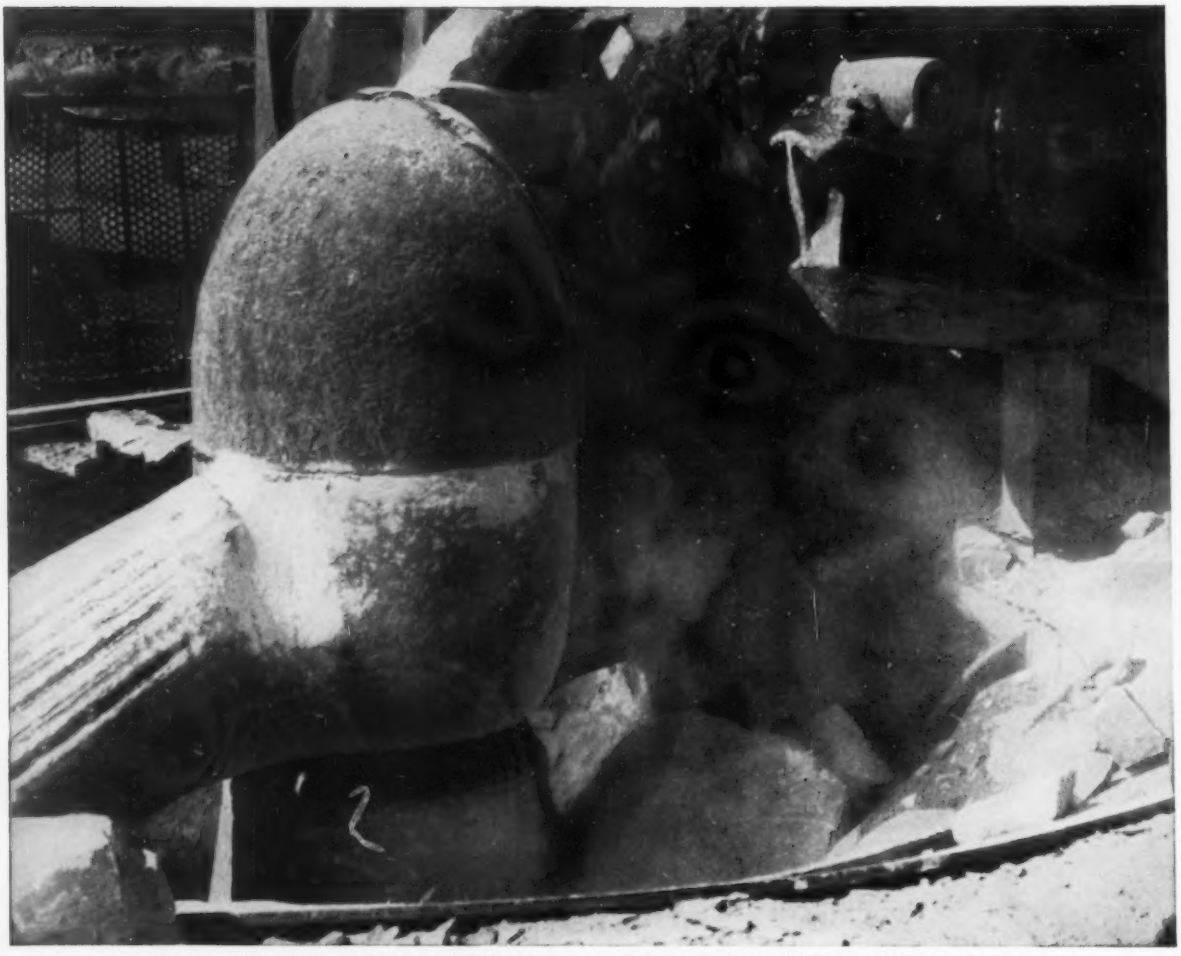
as a "buck wall," providing protection against slides in the pit.

Production can be adjusted to suit your requirements and the cost per cubic yard of material dug is lower than by any other method.

For details on how a wheel excavator may be applied to your operations consult Bucyrus-Erie Company, South Milwaukee, Wisconsin, Dept 5LD

BUCYRUS ERIE®

Builds Better Equipment



Crushers like this — fitted with Ni-Hard concaves — are turning in impressive service records at Spencer Quarries, S. D. They crush Sioux Quartzite, which, like Taconite, is among the hardest known minerals . . . and it has a compressive strength of over 100,000 psi.

NI-HARD crusher concaves outlast manganese steel 3 to 1

At Spencer Quarries, Spencer, South Dakota, Ni-Hard* concaves in 6-inch crushers, have lasted three times longer than manganese steel rings in the throat area, where compression forces are highest.

In a 30-inch gyratory crusher at Spencer, Ni-Hard bottom ring concaves are in their third year of service—where previously the best manganese steel rings wore out in six months. All of Spencer's Ni-Hard concaves were supplied by Brom Machine and Foundry Co., Winona, Minn.

Whether crushing quartzite at Spencer or working tough Taconite on the Mesabi Range, economical Ni-Hard nickel-chromium cast iron is proving better able to resist abrasion and high compression forces than any other material.

Ni-Hard concaves are available from authorized producers throughout the country. For the address of the one nearest you, write to Inco.

*Registered trademark

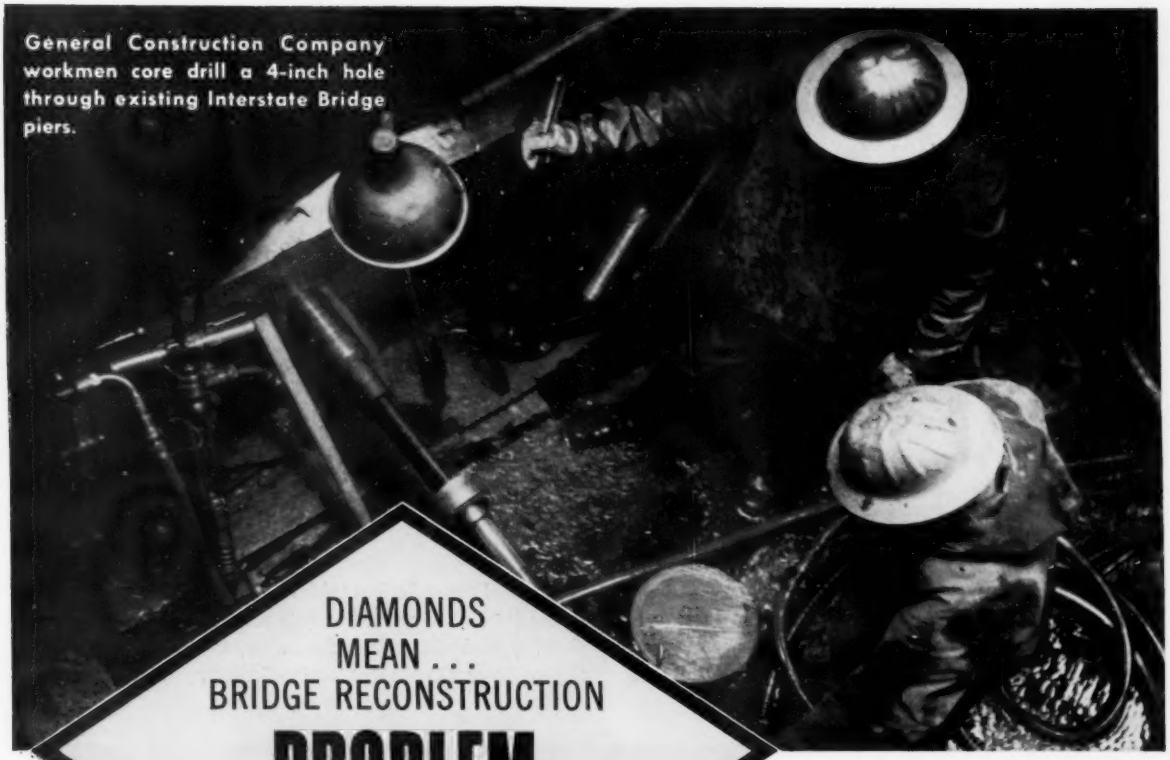
THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall St. INCO New York 5, N. Y.

Looking down the throat of a gyratory crusher. Concaves in the important lower ring are of long-lasting Ni-Hard.

NI-HARD

NICKEL MAKES ALLOYS PERFORM BETTER LONGER



General Construction Company workmen core drill a 4-inch hole through existing Interstate Bridge piers.

DIAMONDS MEAN . . .
BRIDGE RECONSTRUCTION

PROBLEM SOLVED!

Christensen Custom Designed Diamond Equipment Aids in Interstate Bridge Reconstruction

Raising the Interstate Bridge between Portland, Oregon and Vancouver, Washington is a mammoth job that demands specialized equipment. The reconstruction of the Interstate Bridge is under the supervision of the Oregon State Highway Department, A. A. Rear, Resident Engineer. Aimed at providing additional vertical clearance for Columbia River traffic, five concrete piers are being heightened as much as 38 feet, requiring enlargement of their bases with new concrete. To tie the new concrete to the old, 45 holes were core drilled. These holes were 14 feet long and four inches in diameter to allow insertion of heavy steel rods. These tensioned rods, projecting six feet from each end of the holes, assure proper adherence of the new concrete to the existing bases. The special bit and core barrel necessary for this job were designed and manufactured by Christensen under the supervision of T. R. Harris, General Superintendent, General Construction Company of Portland. This unique equipment was specifically designed to operate economically in a confined space 40 feet below the river surface. Maximum efficiency and complete customer satisfaction were achieved.

If you have a unique operation or a particularly difficult drilling problem that requires specialized equipment, consult Christensen about diamond drilling equipment manufactured to your requirements.

Diamonds Mean, "Less cost per foot."

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH SECOND WEST • SALT LAKE CITY, UTAH

toughest
portable
power
cables
made!

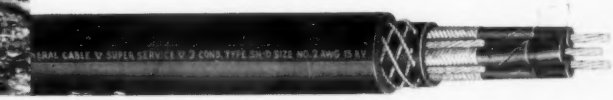
SUPER SERVICE

Where the going is rough, men who know mining have proven that General Cable's complete line of Super Service Portable Power Cables are built better to last longer than any other. From many years of field experience, General Cable has engineered each construction from conductor to jacket to stand up to the most rigorous service conditions. The *Supertuf* jacket is extra tough, extra tear resistant, exceptionally resistant to abrasion and outstandingly resistant to oil, acid, water, flame and sunlight.

Stocks of Super Service cables are maintained at a General Cable distributing center handy to your location. The brochure showing the basic types and sizes may be obtained at any of the 65 General Cable Distributing Centers.

FLAT TWIN for use on shuttle cars, cutting machines, loaders, drilling units and other d-c equipment.

TYPES W and G for heavy-duty mobile equipment and d-c and a-c mining machines.



SH-D SHOVEL CABLE for high voltage supply with maximum safety to shovels, dredges, cranes and draglines.

GENERAL CABLE CORPORATION, 730 Third Avenue, New York 17, N. Y.
Offices and Distributing Centers Coast-to-Coast

for quality and service specify... GENERAL CABLE

For Mining and Smelting Operations . . .

WESTERN PRECIPITATION

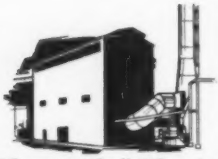
The Only COMPLETE Line of GAS-CLEANING EQUIPMENT!

COTTRELL

Electrical

PRECIPITATORS

► Western Precipitation is the organization that pioneered commercial application of the now-famous Cottrell process of *electrically* precipitating dust, fume, fly ash and other suspensions from gases. No other organization has had such extensive experience in this highly-technical field . . . no other offers such advanced developments and range of equipment . . . no other provides such unbiased recommendations on the type of installation best suited to *your particular* requirements. **For further data write for "Cottrell" literature!**



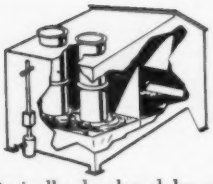
THERM-O-FLEX HI-TEMPERATURE

Filter

SYSTEMS

► "Therm-O-Flex" Filter Systems clean gases as hot as 550°F.—with virtually 100% collection. They incorporate new type silicone-treated, woven glass filtering elements that not only resist high temperatures, but also are cleaned automatically by intermittent collapsing—not by destructive shaking. The "Therm-O-Flex" has no moving parts, nothing to require frequent servicing or replacement, and offers substantial savings in both installation and operating costs. **For further data write for "Therm-O-Flex" literature!**

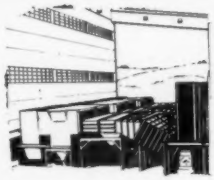
► Where continuous reverse-jet cleaning is desired—and high temperatures are not a factor—Dualaire Reverse-Jet Filter Systems are also available. **Write for "Dualaire" literature!**



TURBULAIRE-DOYLE

Scrubbers

► Orginally developed by one of the industry's largest mining and swelting companies—and used extensively in its own diversified operations—Turbulaire-Doyle Scrubbers offer many important advantages for wet scrubbing types of dust collection. *Jet action* scrubbing insures unusually high collection efficiencies—*yet there are no moving parts, nothing to require frequent maintenance or repair.* Compactness, simple installation, ready adaptability to corrosion-resisting construction are among other Turbulaire-Doyle advantages. **Write for detailed Turbulaire-Doyle literature!**



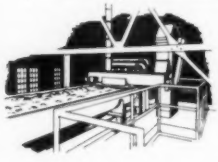
MULTICLONE

Mechanical

DUST COLLECTORS

► The Multiclone pioneered the modern principle of multiple, small-tube, high-efficiency centrifugal collectors—and is still unequalled in the field. Not only does it offer the higher separating efficiencies obtained by the greater centrifugal forces developed in multiple *small*-diameter tubes, but the Multiclone also is easier to service and maintain . . . is simpler to install because it requires no costly, complicated ducting . . . is far more compact . . . and offers many other important advantages that save money and boost efficiency on mechanical dust collection applications. **For further data write for "Multiclone" linterature!**

. . . and for modern Heat-Exchange operations



Holo-Flite

PROCESSORS

► Holo-Flite Processors circulate heating or cooling fluid through the hollow shaft and blades of a conveyor screw, thus processing granulars, fluids or sludges as they flow along in *continuous* bulk flow. Far faster and more efficient than batch processing. "Holo-Flite" heats and dries with Hot Oil to 600°F. . . . with Dowtherm to 750°F. . . . with Steam to 150 PSI. Cooling range 1800°F to 0°F. Multiple "Holo-Flite" tiers can be stacked for high capacities in minimum floor space. Many other cost-cutting advantages. **For further details write for "Holo-Flite" literature!**

Only WP has all 6

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This Cat No. 12 Motor Grader works 16 hours a day, 6 days a week, all year round for the Tecumseh Coal Corp., Boonville, Indiana. Its many jobs vary from cleaning up coal to grading haul roads.

LOOK! THESE IMPROVEMENTS IN THE No. 12 PAY OFF IN EVEN HIGHER PRODUCTION!

Increased throat clearance **New blade, lift and circle** **One-piece case for transmission and final drive** **New, two-tooth power control clutches** **New, positive mechanical lock**

SINCE it was introduced twenty-one years ago, the Caterpillar No. 12 Motor Grader has earned the title "standard of the industry." Constant improvements have kept it the undisputed leader in its class. Here are the latest improvements that enable you to get even more work at lower cost with less maintenance from this high-production machine:

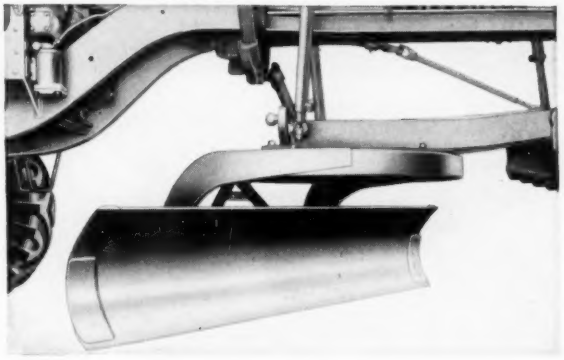
1 Clearance between the top edge of the blade and bottom edge of the circle has been increased to 5 INCHES. This provides improved rolling action, allows more material to move across the blade for greater production.

2 Blade thickness has been increased to 7/8 inch and blade beams have been increased in length and thickness to handle heavier loads. Lift arms have been lengthened and links shortened to enable operator to obtain all blade angles more easily. Circle reverse gear housing has been redesigned for better clearance as well as to increase the life of components and make service adjustments easier.

3 There's a new, stronger one-piece case for the transmission and final drive. This eliminates possible leakage at gaskets. In addition, transmission bearings have been strengthened for longer gear life.

4 New mechanical controls for reduced kickback, easier engagement. New power control clutches have two teeth, instead of four, and improved contact angles. They are more positive to engage, easier to hold in position.

5 New blade controls feature a positive mechanical lock—exclusive with Caterpillar. When the control is in neutral, the power shaft is locked by a set of gear teeth to prevent creeping.



See the improved No. 12 at your Caterpillar Dealer. Whatever the job, he has the right capacity motor grader for it. Besides the 115 HP No. 12, there's the big new 150 HP No. 14 and 75 HP No. 112. Ask for a demonstration!

Caterpillar Tractor Co., San Francisco, Cal.; Peoria, Ill., U.S.A.

CATERPILLAR

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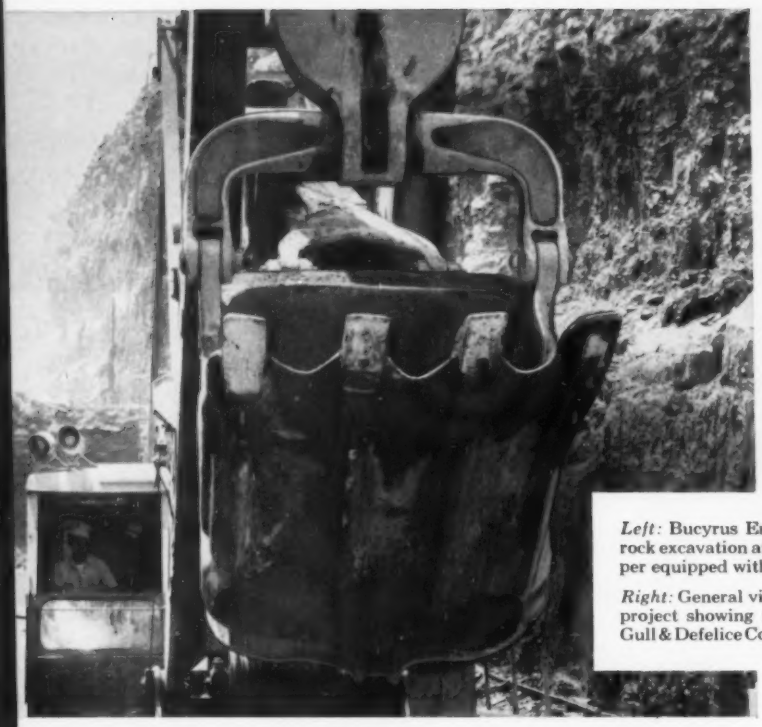
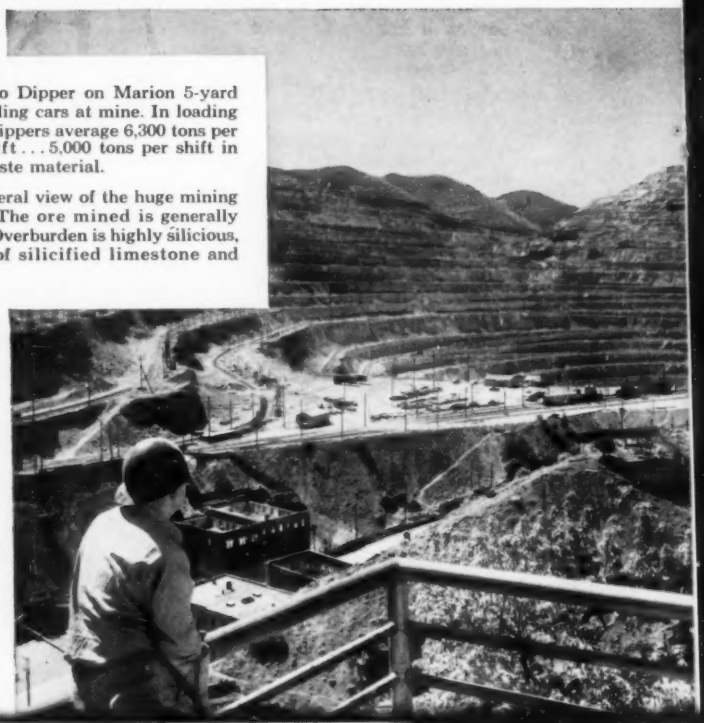
STEP UP PRODUCTION WITH THE IMPROVED No. 12

How AMSCO helps you MOVE



Left: Bucyrus Erie 88B shovel used for rock excavation at Conduit #2 South. Dipper equipped with Amsco Simplex Teeth.

Right: General view of Conduit #2 South project showing rocky terrain in which Gull & Defelice Construction Co. operates.



Left: Amsco Dipper on Marion 5-yard shovel, loading cars at mine. In loading ore, these dippers average 6,300 tons per 8-hour shift . . . 5,000 tons per shift in working waste material.

Right: General view of the huge mining operation. The ore mined is generally porphyry. Overburden is highly silicious, composed of silicified limestone and quartzite.

to prevent creeping.

MORE TONS PER DOLLAR

Read these user reports on how AMSCO Dippers and Teeth perform in rugged digging service

ON THE NIAGARA POWER PROJECT

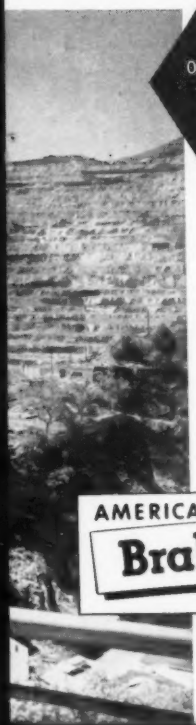
40,000 YARDS OF ROCK HANDLED BEFORE AMSCO 2-PART TEETH NEED REPLACING

Gull & Defelice Construction Co. is working on Section 3 of the powerhouse conduit project – excavating 140 feet deep, almost entirely in rock. All five power shovel dippers on the job are now equipped with Amsco Simplex 2-Part Reversible Teeth.

These dippers work *16 hours a day, 6 days a week for 2 weeks--handle approximately 40,000 yards of rock* – before tooth replacement is required.

Says Mike Cazzolla, Equipment Superintendent, in talking about the Amsco teeth: "They're built rugged and take a lot of punishment from the rock. We get longer wear out of them because we can turn them over." He's referring, of course, to the reversible tip feature.

John Cazzolla, Master Mechanic, adds the important fact that *they can replace these teeth in ten minutes with no trouble.* This feature, together with the longer wear, means important savings in downtime.



AT ONE OF WORLD'S LARGEST COPPER MINES

THEY USE AMSCO DIPPERS ...FOR HIGH-SHOCK, HIGHLY ABRASIVE DIGGING

This huge copper mine operates the largest collection of big power shovels (5 yards and up) in the world. For this rugged service they use Amsco dippers to strip off extremely abrasive overburden ... handle waste material ... and load copper ore. These are cast manganese steel dippers – built for toughness, high abrasion resistance and long service life.

For rugged digging anywhere

... wherever high impact and abrasion are problems, you'll "move more tons per dollar" with Amsco Manganese Steel Dippers and Simplex 2-Part Reversible Teeth. See your power shovel equipment dealer for sizes and types available. Or write us direct for technical bulletins on Amsco Dippers and Simplex 2-Part Teeth.

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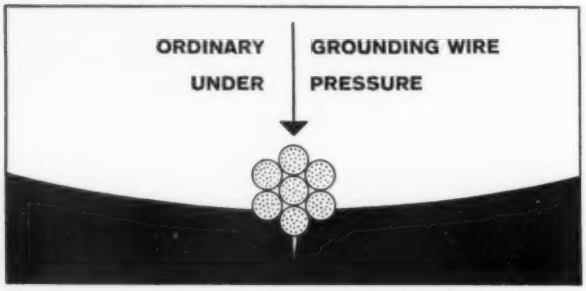
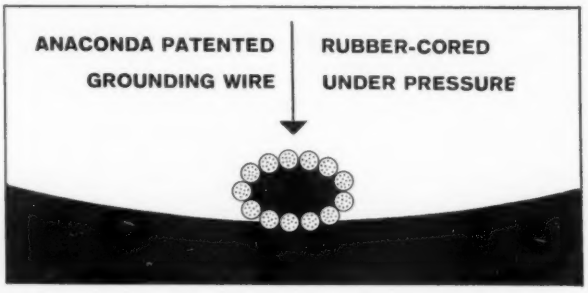
IN-USE SITUATIONS LIKE THE ONE SHOWN HERE prove why Anaconda Shovel Cable with its patented rubber-cored grounding wire outlasts ordinary cable. Under pressure, Anaconda's exclusive rubber core helps spread out the pressure—prevents internal damage. When ordinary grounding wires are subjected to the same pressure, the solid cores often cut the insulation.





Here's why Rubber-Cored Grounding Wires help Anaconda Shovel Cable last longer!

Abuse in service can seriously shorten the life of shovel cable—unless it has built-in protection, such as you find in Anaconda Shovel Cable. For grounding wire failures are one of the most common troubles. See how Anaconda engineers have solved it:

In the diagrams above you see, at left, ordinary grounding wire: a hard, compact group of stranded ropes. And at right, Anaconda patented rubber-cored grounding wire; flexible groups of stranded ropes around a soft *rubber core.*

When great pressure is applied to ordinary grounding wires, the small, hard grouping of wires bites into the insulation. Result: cut and damaged insulation. *But* with Anaconda grounding wires:

- Anaconda's rubber core acts as a cushion and helps spread out the pressure—resisting damage to the insulation.
- Individual conductor strands are protected, too, to resist the kinks that so often are the cause of fatigue failure.
- Anaconda's grounding wires provide broader contact with the shielding making a more positive ground.

For longer lasting shovel cable, see your Anaconda distributor or the Man from Anaconda. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 58319

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ASK YOUR **ANACONDA®** DISTRIBUTOR
ABOUT **SHOVEL CABLE**

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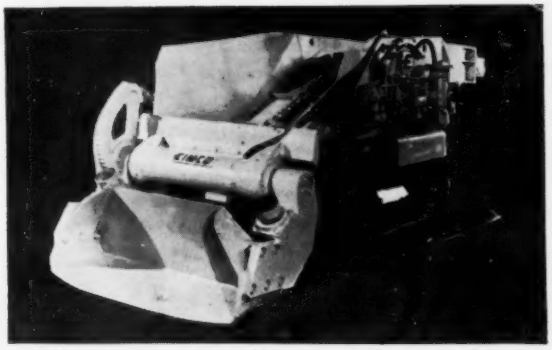
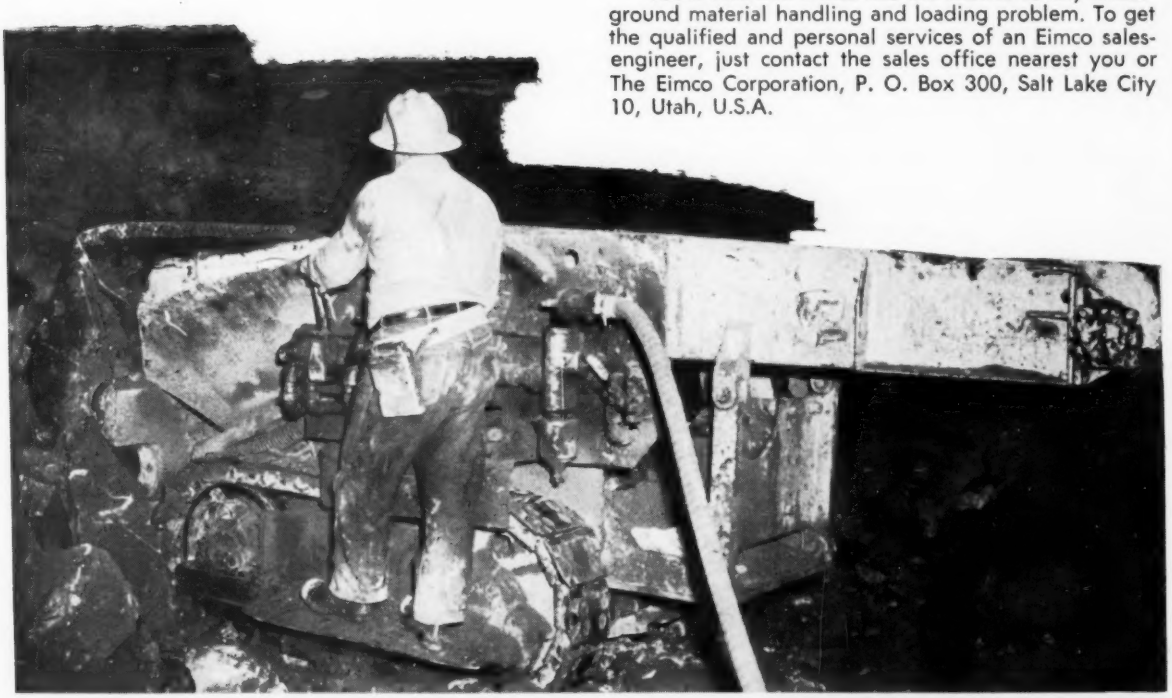


"OUR EIMCO® 635 CONVEYOR LOADER IS THE FINEST PIECE OF EQUIPMENT WE OWN!"

That's the enthusiastic word from T. W. Newell, Vice - President and manager for Shattuck Denn Company. Operating a five foot low-headroom machine at their Bardon Shaft near Moab, Utah, this progressive mining company is presently driving seven headings. Their efficient Eimco 635 Low Headroom Conveyor Loader handles four per shift, loading into shuttle buggies. Complete time cycle of loading each three to four ton buggy is consistently under two minutes and usually closer to 100 seconds; is capable of handling 100 tons per hour.

Frank Garrett is mine superintendent at this operation, which also uses an Eimco Air Tugger Hoist to pull the drill jumbo to one side when it is hoisted out of the shaft and an Eimco 42" Folding Scraper to load their skip pocket.

You'll find that Eimco has the answer to any underground material handling and loading problem. To get the qualified and personal services of an Eimco sales-engineer, just contact the sales office nearest you or The Eimco Corporation, P. O. Box 300, Salt Lake City 10, Utah, U.S.A.



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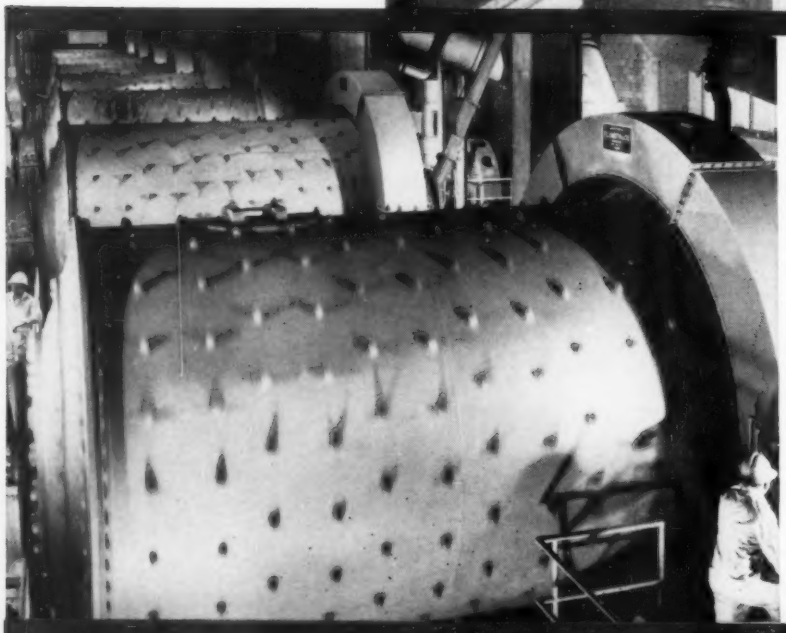

grinding mills

Ball mills, tube mills and multicompartment mills—open or closed circuit—wet or dry grinding.
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MINING WORLD

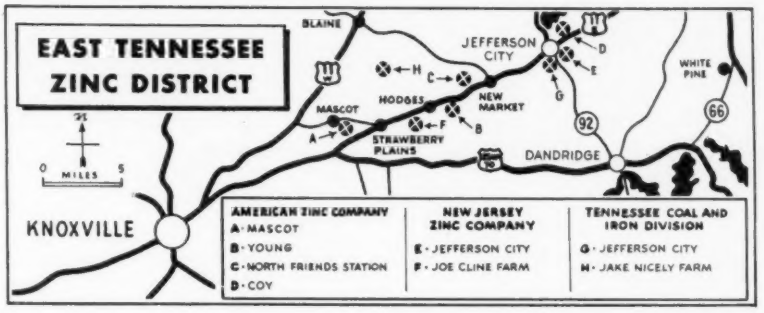
East Tennessee Zinc District Still Growing

East Tennessee's zinc district is scheduled to have two new zinc mines. The Tennessee Coal and Iron Division of United States Steel Corporation and the New Jersey Zinc Company have recently bought farms on which they have been conducting surface drill hole exploration. Both companies presently operate mines in the district at localities shown on the map.

The main operating mines of the American Zinc Company of Tennessee, the district's largest operator, are also shown.

Tennessee Coal and Iron bought part of the Jake Nicely farm, marked "H" on the map, located on the Strawberry Plains syncline. The new shaft reportedly will be 2,000 feet deep.

The Joe Cline farm marked "F", which has been under option to New Jersey Zinc for three years, has been extensively drilled with the aid of a DMEA loan. Some 600 acres of the farm were sold for $95,000.



Tennessee was the largest zinc producing state in 1958—58,500 tons. Ore is mined from large flat lying deposits in the Knox dolomite of Ordovician age. For a detailed report on the ore deposits and geology of the district, see Charles R. L. Oder's article in the June 1958 issue of MINING WORLD.

New Shaft for Mt Isa's Copper Expansion

- **Will hoist from 3,000 feet at 19,000 tons per day**

Mount Isa Mines Ltd. in Queensland, Australia will sink a new shaft with an ore hoisting capacity equal to that of any deep underground mine shaft in the world. Its cost will be several million pounds, and it will take five years to complete.

The shaft will be equipped to hoist 800 tons of ore per hour from 3,000 feet—twice the capacity of the present shaft. The new round shaft, 24-feet inside diameter, will be concrete lined with steel buntons and sets.

There will be two cages, the larger one capable of handling a 20-ton, 3-foot 6-inch gauge electric trolley locomotive without disassembling. These locomotives are now being installed for underground ore haulage.

Mount Isa is currently mining, hoisting, and milling more than 8,000 tons per day and, with doubling of copper output scheduled, additional hoisting capacity must be achieved to keep pace with recent and current expansion in all other facilities.

Expansion of all Mount Isa's power, mining, milling, smelting, and transportation facilities has been underway for some time. Recent emphasis has been on expansion of copper output which was about 40,000 tons in 1958. This is to be raised to 60,000 tons in 1961, with a further expansion to 80,000 annual tons scheduled.

Separate and distinct, although closely adjoining, copper and lead-zinc ore bodies are mined. Copper ore output is being increased and lead-zinc decreased. Recent tonnages mined were copper, 102,550, and lead-zinc, 80,585, in period No. 8, for a total of 183,135. Copper target is now 120,000 tons and lead-zinc 63,000 in period 9. Copper output is going higher immediately.

Recently completed expansions include a third crushing section, several new 60-foot copper thickeners, installation of a third rod mill, the 13th ball mill, new flotation cells, and a new steam-electric plant at Mica Creek.

American Smelting and Refining Company is now the major stockholder in the company. Since 1930 Asarco has been an important stockholder and for a number of years acted as technical manager before it became the principal stockholder in 1948.

Arizona Pilot Plant For Cu-Ion Exchange

Bagdad Copper Corporation plans an early reopening of its pilot electrolytic plant closed since mid-1957. It had been an experimental and research center for production of finished copper sheets from copper concentrates and from leaching lowgrade copper deposits. It was closed in order to use plant facilities for further research.

During the past two years, Bagdad's chemists and metallurgists have devised a potential process through adaptation of an ion exchange unit coupled with a resinous flow. In effect, the copper-bearing solution from the leached ore is piped through a circuit where it contacts the resin, which replaces the detinned cans formerly used. During contact, a chemical reaction occurs which causes copper particles in the solution to attach themselves to particles of resin in a highly concentrated mass form.

HIGH OUTPUT per machine shift in this Argentine vein shrinkage stope achieves low mining costs.

Idarado Know-How

Mines 47.6 Tons Per Machine Shift From Narrow Veins in Shrink Stopes

By George O. Argall, Jr.
Editor

An old axiom—raise the tonnage to cut costs on a per ton basis—has been disproved by Idarado Mining Company in Colorado's San Juan Mountains. Idarado had to cut both tonnage and costs in order to stay in business.

With the over supply of base metals and resultant drop in metal prices Idarado did follow the axiom "Don't give your metals away for nothing." Thus the plan was to operate at reduced tonnage, to mine and mill more efficiently, to improve caliber of mine crews while cutting their number, and do all these at once in order to cut cost of producing each pound of metal.

Idarado has succeeded and is operating thanks to cooperative efforts of management, staff, and employees.

With labor 55 per cent of total cost, this meant that labor productivity—tons broken per machine shift —had to be raised. In 1957 4.61 tons were mined and milled per over-all man shift; this was raised to 4.98 in 1958 for a 7.4 percent improvement.

Idarado Must Be Many Things

Idarado Mining Company is more than a mining company. It is the consolidation of a large number of famous Colorado mining companies and mines, including the Smuggler Union; the Black Bear; Telluride Mines, Inc.; Liberty Bell; Tomboy Gold Mines, Inc.; Treasury Tunnel; Humboldt; and Atlas Mining Company.

Idarado is a multi-vein company with control and/or important ownership of the Montana, Black Bear, Argentine, Ajax, Liberty Bell, Flat, Smuggler, Ansborough, Pandora, and Atlas vein systems. Idarado is the owner of several hundreds of mining claims and mill sites.

Idarado is the operator of two major interconnected mines with portals 5.5 miles apart and on opposite sides of the 13,500-foot-high San Juan mountains.

Idarado is four main operating levels: Treasury Tunnel, Meldrum, 2400 Argentine, and Mill Level. It is six main hoist equipped internal raises: Treasury raise, 2013 raise, 2930 raise, Cincinnati raise, and 2947 raise.

Idarado operates a 1,800-daily-ton- flotation-gravity mill recovering free gold by jigging and amalgamation, and lead, copper, and zinc by differential flotation.

Geologically, Idarado is a vein explorer and miner from the Cutler red beds of Permian age through the Dolores, Entrada, Pony Express, Bilk Creek, and Telluride sediments into the Tertiary volcanics which comprise the San Juan tuff, Pyroxene andesite, Hornblende latite and rhyolite, and Treasury Mountain quartz latite.

Idarado is the producer of over $70,000,000 in new wealth since 1944 as a consolidation of the Treasury Tunnel, Barstow, and Black Bear mines.

Technically, Idarado is an industry leader in bit and drill steel practices, high raise driving, shrinkage stoping, and differential flotation.

Economically, Idarado is the largest employer and one of the major taxpayers for Ouray and Telluride, the respective county seats of Ouray and San Miguel counties, Colorado.

Tons per man shift underground increased 9.4 percent from 7.16 to 7.95. In the same period ore tonnage mined and milled was slashed from 457,850 to 382,100, a 16.5 percent cut.

Man made and natural advantages were important in achieving these results. Advantages include: ample financing, a good physical plant constantly kept in repair; adequate warehousing and supplies; an excellent mechanical department; no pumping; no ore hoisting; veins with good walls; continuous ore over strike lengths of 15,000 feet and vertical heights of 3,400 feet; impressive mining widths; good natural ventilation which is supplemented by 100,000 cubic feet per minute of forced ventilation; location of Treasury Tunnel portal on main paved highway served by regular transcontinental truck lines; aggressive management; and, last but not least, five pay metals—gold, copper, lead, zinc, and silver.

It's not as easy as it may sound for there are formidable disadvantages, too: hard ore; low-grade ore (in 1958 the mill recovered 0.06 ounce gold, 1.9 ounces silver, 1.5 percent lead, 0.70 percent copper, and 3.3 percent zinc per ton); high altitude with stopes as high as 12,800 feet; long distances (both vertically and horizontally between supply points, stopes, and mill); necessity for several ore passes; 80 minutes per shift travel time—all paid for by company—for miners; and an exceptionally heavy spring run off which channels water through veins into raises, drifts, and ore passes.

One of the first and most important accomplishments in 1958 was cleaner mining by cutting down on wall rock dilution as the direct result of continued close supervision of drilling and blasting. A notable increase in sulphides sent to mill was an immediate result of this program.

A second important factor was the mechanical department which always had an extra machine or a spare motor available where is was needed. Miners don't wait for supplies or tools at Idarado. Compressors are located underground to deliver air more efficiently to nearby stopes. The mechanical department designed and installed the five-mile-long, underground, high-voltage system from the Treasury Tunnel portal to the Pandora mill so that all electricity would be metered in one place to take advantage of lower killowatt cost with higher demand.

Preventive maintenance and accurate records cut mining costs every day. A better brake requiring less maintenance has been developed for battery locomotive, the speed of slushing has been cut from 350 to 200 feet per minute by changing motor drive. This results in less rope wear and breakage, less shock load on the electric motor. Another important project has been the conversion of main line haulage locomotives to Diesel electric drive for greater control and economy of operations.

Constant study is made of supply logistics. Most supplies move into mine from Treasury portal; all ore moves away from this portal toward and out the Mill Level tunnel. Thus, there is no interference or waiting by ore trains while supply trains are being unloaded. Many mine supplies are warehoused at key underground points. Even the Diesel locomotive fuel is hauled into mine through Treasury Tunnel and piped with gravity flow to centralized fuel and lubrication stations on the main levels below. You don't handle drums heavy with water condensate in fueling Idarado Diesels.

Idarado is a big mine—miners enter at two portals, 5.5 miles apart with a 1,493 foot differences in elevation. Yet they work side by side in adjoining stopes.

Idarado is an up-side-down mine with all ore dropping through a series of ore passes up to a total length of 2,893 feet before reaching the mill. Raising instead of sinking develops ore.

Idarado stopes are scattered in order to obtain a balanced mill feed despite mining economies which would result if only one major stope on one vein was mined at a time. The company's view is for orderly development and mining over the long term. However, mine crews are concentrated in stopes that are being mined, and such stopes are mined fast, to gain the advantage of closer supervision, and easier and more efficient handling of supplies into stopes

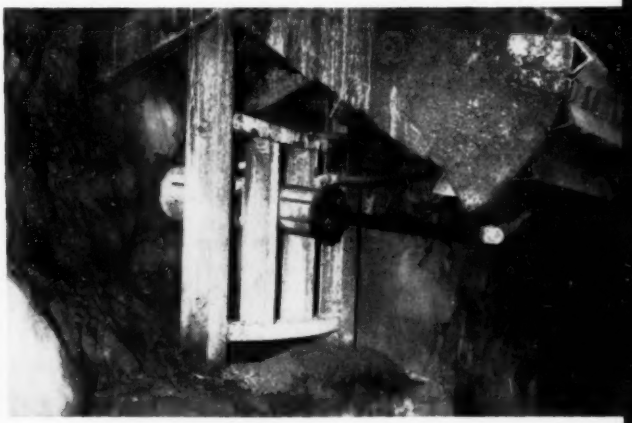
Management is not standing still in its battle to achieve greater productivity—to break more tons per man shift. However, in several areas where further mechanization is possible, the capital cost is so high that improvements are justifiably slow.

John S. Wise is general manager; A. C. Hilander, general superintendent; John Kearney, mine superintendent; W. L. Griffiths, mechanical superintendent; M. A. Jorgenson, mill superintendent; J. C. Keenan, chief engineer; G. C. Forbes, chief clerk; and Kenneth Tatman, chief metallurgist.

To Profitably Mine Narrow Veins

CAR PASSING CUTOUTS, every 250 feet, in development drifts will next be used to drive ore pass raises in stope preparation. Canton car transfer is moved ahead as drift progresses.

STEEL CHUTE GATES with air actuated undercut lips are standard for all main Idarado chutes. They assure fast loading and good control of fine wet muck for many long ore passes.



Idarado's Stoping

Mine Long Backs, Slush to Raises

The stope miner is King at Idarado. The entire operation is planned, scheduled, and directed to one end—break more tons of ore per machine shift.

With only seven active operating stopes, each having two machines per shift, 42 men in stopes (28 machines) are supported by a larger number of supply and auxiliary personnel—normally about 157 other mine crew, 27 mill crew, 74 in shops and surface, and 11 doing miscellaneous jobs.

With stopes and stope preparation supplying 282,985 and 72,264 tons, respectively, of ore broken in 1958, stoping (ore extraction) is the most important mine function. It's the costliest operation, too, representing 60.4 percent of total cost.

By mining long stope backs, 500 feet (250 feet on either side of raise) and 6.5 feet wide on an average, and mining them fast only seven active stopes are in operation at one time at present tonnage rate. Normally stope preparation is underway on six or seven new stopes. A typical Argentine vein stope, shown in photographs, will produce 5,000 tons of ore per month with two machines per shift. Stope crews are made up of two miners and a slusher operator who also loads drill holes, levels muck pile, and helps miners set up.

In April, 1959, there were 97 man shifts (actually 2.5 shifts per three man crew) in this stope to break 5,212 tons of ore. This required drilling and blasting of 14,334 feet of hole. Productivity was 53.7 tons per man shift, 0.36 tons per foot of hole, and 24.6 holes per man shift.

A typical Black Bear vein stope has a higher productivity because the vein is easier to break. An average of 18.3 holes per man shift breaks 55.1 tons which is at a rate of 0.50 tons per foot of hole. There is only a small difference in stope widths with Black Bear a little wider. The Argentine vein, however, follows a pre-mineral dike which complicates clean mining at times.

The most unusual feature of narrow vein stoping at Idarado is slusher draw of broken muck.

It was proven several years ago that it cost too much money for normal stope preparation and multiple chute loading. The cost of timbering and building chutes on 25- or 30-foot centers following back stoping made this method, used successfully in many mines, completely out of question. A possible alternative which has been widely used, too, would have been to drive chute raises and interconnect them, leaving a series of chutes and pillars. Again, the high cost ruled against this method.

It was decided to try slushing ore from several stope draw points to a central chute for loading. To try this plan, a two-compartment raise was driven at end of a stope on the Black Bear vein just above the Treasury Tunnel level. A flat drift or inclined raise, 25°, was then driven in the vein from the raise to serve as the slusher scram drift. Every 25 feet a raise was driven and the top of each interconnected to form a stope sill cut out. Shrinkage stoping was then started with swell from broken ore slushed down incline to chute. The method worked and costs were lower than for other types of shrink stoping. It was soon determined, however, that it was not necessary to drive inclined scram drifts.

Now, two stopes are 500 feet long, 250 feet on either side of manway, supply, and ventilation raise which is first driven through to level above. Scram drifts, 7 feet wide and 6 feet high, are then driven along vein from raise in both directions to end of stope. A double-drum 20 or 30 horsepower, Vulcan, Joy or Ingersoll-Rand hoist is set up at raise and is used to muck out drifts as they are being driven.

Stopes are high, usually about 250 feet, as well as long because it costs too much to drive drifts on 100 or 150 foot levels. Idarado can't afford close level development so some stopes are mined 765 feet high between main tramming levels. There is, however, a second and third slusher drift driven at 250 foot intervals off the main raise. Actually this makes three separate and independent stopes. Development costs are much lower by this method.

Every 25 feet in the scram drift two cross cut rounds, the first 6 feet high and 12 feet wide, and the second 7 feet high and 8 feet wide, are shot in footwall. Then, from the back end of the cross cut 8 by 5 foot raises are turned back into the vein. The top of these raises are belled out, interconnected, and shrinkage stoping started.

These crosscuts and raises form draw points. By placing the raise at the back end of the crosscut, the bottom of the muck pile just comes to the edge of the scram drift. Thus, slushing from raises further away from the slusher hoist doesn't disturb the muck in any other draw point than the one being slushed. When the miner wants to pull down any draw point, he places the tail block on the far side of the crosscut so that the bucket can be loaded in the crosscut.

Today all Idarado stopes are developed and mined in this manner. While it does require more stope preparation to drive the scram drift, the

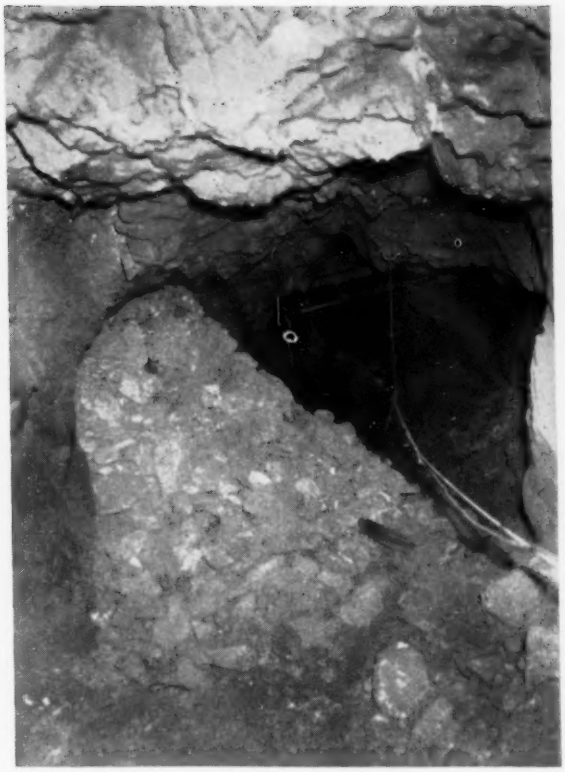
MINERS RIDE steel skips to bulkhead while driving high raises. All supplies are hoisted on same skip.

Relative Costs[1] For Driving Idarado Drifts-Crosscuts and Raises in 1958

Item	*Drifts-Crosscuts*	*Raises*
Labor	15.4	25.3
Explosives	6.3	6.3
Timber	0.6	4.8
Indirect cost	27.4	45.7
Overhead	10.9	17.9
Totals	60.6	100.0

1. Using Index Number of 100.0 For Total Raise Cost

CLEAN MINING breaks only vein in this shrinkage stope. High grade on footwall with lower grade fractured vein on left. Pillars are left where walls are bad.



SLUSHER DRAW POINT full of muck shows how careful driving of raise feeds muck into scram but does not block it. Vein dipping to right is in back. Draw point crosscut in footwall

saving in chute building, chute loading, and chute maintenance has paid big dividends.

By careful planning many of the raises into which broken ore is slushed serve as major ore passes extending from the higher levels to a lower main haulage level. This means that slushing to pull stope down to get proper room to drill off the muck pile is independent of tramming rates. By coordinating tramming and slushing, there is never any delay in getting room to drill in the long stopes.

Drilling and bit and steel practices have been described elsewhere. Holes are spaced from 20 to 30 inches apart depending on width and nature of vein.

All back holes are drilled with stopers—Gardner-Denver or Ingersoll Rand 48.

The veins are hard to drill because of the many scattered vugs in which steel gets out of line or hangs up. Shift bosses mark location and size of pillars which are left when the walls are bad or vein is barren. There aren't too many of these pillars, however.

All holes, 6 feet deep, are loaded with 1-inch powder. In the last several years, lower strength, greater bulk, and lower cost powders have been introduced and every change from Gelex to No. 2 and then to No. 3 has saved money. Today trial of the new DuPont Hi Cap No. 1 is underway. Trials will also be made using the cheaper powders.

All stope holes are shot electrically with millisecond delays which give better fragmentation. All caps have iron leg wires. This is at the request of the milling department which found that copper lead wires interferred with jig recovery of gold. The iron wires are easily removed from ore with a magnet ahead of fine grinding.

By using a smaller diameter powder (1-inch) in 1958, the powder cost per ton was cut 0.7 cents, despite an increase of 0.71 cent per pound in the price of powder used. Powder accounted for 67.9 percent of explosive cost in 1958; cap cost was the remaining 32.1 percent. Raises with smaller cross sectional area are more expensive to break than drifts. Total explosive cost per foot of raise was $6.94; powder, $4.71. Drift explosives averaged $4.77 per foot with powder $3.24. Argentine vein stopes varied from 29 to 68 cents per ton explosive cost, while the easier breaking Black Bear stopes varied from 15 to 28 cents per ton broken.

Management has reduced from 5.0 to 3.6 employees underground serving each driller. This includes drill doctors, electricians, car repair crew, hoist men, motor men, nippers etc.

This is one of the best methods for improving productivity—to break more tons per man shift.

New methods and new equipment are constantly under study to increase productivity.

Breakdown of Idarado Stoping Costs for 1958

Item	*Percentage*
Primary breaking	17.0
Secondary breaking	0.6
Tramming	1.1
Slushing	5.0
Timbering	0.9
Preparation	10.3
Indirect[1]	44.6
Overhead	20.5
TOTAL	100.0

1. Indirect costs include air, hoisting, drills, supervision, engineering, ventilation, electricity, timber, assaying, etc.

TWO STEEL HITCHES hold rail cap at key point in drift. Both a "U" hitch and rock bolts are used.

Idarado's Raises

New "T" Type Looks Promising

High raises, 600 to 850 feet, are a normal part of development. Six men on two shifts will drive 200 feet of standard 6-by 12-foot raise per month (five-day week). Two contract miners drive the raise while a third man (nipper) on level operates the tugger and sends supplies up the raise.

This is a finished two-compartment raise with separate muck and manway compartments and is complete with ladder, landings, timber slide, 2-inch air line, 4-inch vent line, 2-inch water line, electric blasting line, and signal line.

Sets are placed with five-foot four-inch posts, and six-foot pole lagging. "Monkey Ward" steel hitches and rock hitches are used for center and manway stulls. One of these steel hitches, made from discarded drill steel set in two drill holes, is shown in picture with this article.

Raises are driven in the vein so that there are changes in dip. Width of the raise also varies with vein width from a normal 6-foot.

Level muck crews pull the chute down as rounds are blasted. Every 200 feet a control chute is placed in raise so better control of muck height under back can be achieved by raise crews. Thus, the lowermost section can be pulled for tramming independent of raising.

When raises reach a height between 400 and 500 feet on longer raises, a small station is cut and a second tugger hoist and one additional man added per shift. Despite the need for this transfer point for supply rehandling, the uppermost 200 feet of a high raise is normally driven with only a few more shifts than the first 200 feet. Important to speed raising is the steel skip that serves the miners.

Normal stope preparation raises are driven at 400 and 500-foot intervals on the vein so that 200 to 250-foot-long stope backs are mined on each side.

The second type of raise, and it is most important at Idarado, is an ore pass. For an ore pass, the former practice was to drive a regular two-compartment raise through between levels and then start at top to strip lining, sets, slide etc. downward to lowermost level. This takes time and

TOUGH QUARTZ gives tungsten tipped bits a real test in Argentine vein. Over 10,000 bits are used per year.

Idarado's Drilling

Steel and Bit Tests Save Money

It costs money to drill hard quartz veins in Idarado stopes. But, it cost less per foot of hole drilled and less per ton of ore mined in 1958 than it did in 1957.

Specifically the cost of drill steel per ton mined decreased 0.9 cent, 33.3 percent per foot of hole, despite a 2.7 cents per pound increase in the cost of steel.

The bit cost per ton of ore mined decreased 4.7 cents and the cost per foot of hole per bit was cut 1.5 cents. These savings are far greater than they appear at first glance because 402,637 tons of ore and waste were broken in 1958 with 1,518,655 feet of hole, drilled with 11,899 bits.

Alloy drill steel, tungsten carbide bits, correctly regulated air pressure, salvage and reuse of steel, and strict adherence to a carefully established drill steel make-up procedure in the blacksmith shop were methods used to make these savings at Idarado.

Idarado's engineering and mechanical departments continually make tests with different steel and different forging methods to achieve these results.

There are two standard sizes of Crucible CA Double Diamond alloy hollow drill steel: ⅞ inch hexagonal for stoper (raise) and airleg (drifting), and 1-inch quarter octagon for stoper (stope) drilling.

The inch size is cut in 32, 50, 68, and 86-inch lengths; the ⅞-inch in 32, 50, 68, and 86 for raises. An extra long length, 108 inches, is used in the AirLegs.

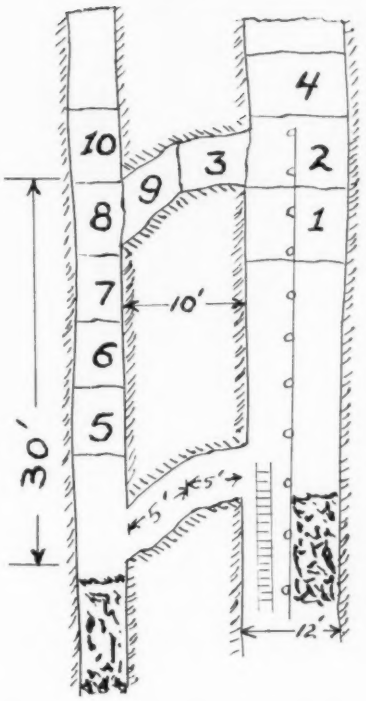
All steel uses Liddicoat tapered-socket tungsten-carbide single use bits. A 5/100-inch-thick brass shim is used between steel and bit to insure a uniform contact and compensate for forging irregularities.

The company's mechanical department has developed its own method for making up steel in the Red Moun-

costs money so a new method of raising, still experimental, was started in early 1959 when a "T-Raise" was driven 741 feet from the 2000 to 1200 level on the Black Bear vein. The T-Raise is actually two separate raises driven with a 10-foot pillar between them. Every 30 feet, an inclined dog hole is driven to connect the two. The smallest raise, 6 by 6 feet, is driven raw and is used as an ore pass as soon as it breaks through to level above. The larger raise, 6 by 12 feet, is a standard stope preparation raise and can be used as a permanent manway. In it, the manway always is carried on the end toward small raise for access to back of either raise. The sketch shows sequence of rounds for driving the T-Raise. As the back of the ore pass nears the level above the raise is driven slightly into foot wall so that it breaks through alongside drift track and side dump cars can be dumped directly into it. The manway section is inclined into hanging wall so that it does not break into drift. A short crosscut is driven to connect the raise and drift. This assures safety at top of raise and doesn't weaken the drift so that an expensive timbering job is necessary.

Importance of raising is demonstrated by the 3,052 feet driven in 1958 which was more than half the total of drift and crosscut footage of 5,956 feet driven.

How Idarado Drives "T" Raise



Manway raise, at right, in diagram must be kept ahead of ore pass raise.

Rounds 1, 2, 3, and 4 shot in order shown.

Crew then moves into ore pass and drives it ahead blasting rounds from 5 to 10.

Breakthrough on round 9 allows muck from round 3 to fall into ore pass.

Ore pass rounds are drilled off sprags with machine etc. stored in breakthrough connection.

Muck cannot be pulled below connection, nor, can it be higher than connection.

Actually rounds 3 and 4, and 9 and 10 are each drilled from one set up.

After each breakthrough manway raise is driven ahead again.

tain blacksmith shop as described in box.

AirLeg steel is given the same tempering treatment on both ends because of the addition of shank and collar.

Grinding to within 1/16-inch of the final taper size insures full diameter of the water hole after forging.

The hexagonal steel drilled 461.3 feet of hole per piece, and the quarter octagon 1,656.3 feet in 1958.

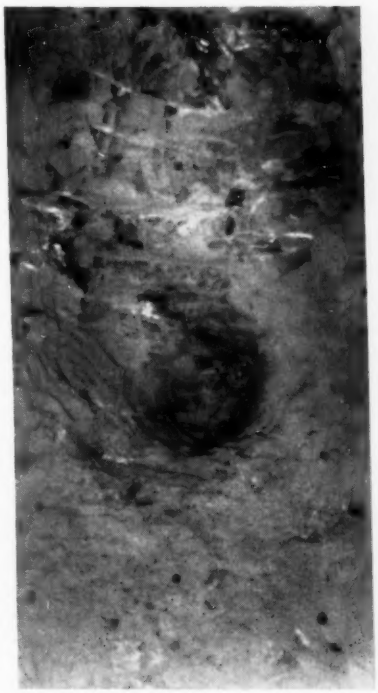
The tapered bit end is the weakest part of the steel with the most breakage. This is due, possibly, to a prestressed condition set up in forging. Cold working the tapered end might reduce this prestressing.

Drilling speed tests show no difference between the two sizes of steel for the same bit size. Speed increased as air pressure increased, from 70 to 100 pounds per square inch, as follows for the quarter octagon: at 70 pounds, 11.41 inches per minute; 80 pounds, 13.78; 90, 15.66; and at 100, 19.17. The fastest is not the most economical, however. The most advantageous pressure appears to be 80 pounds per square inch and Norgren pressure regulators are used in main air lines to maintain it.

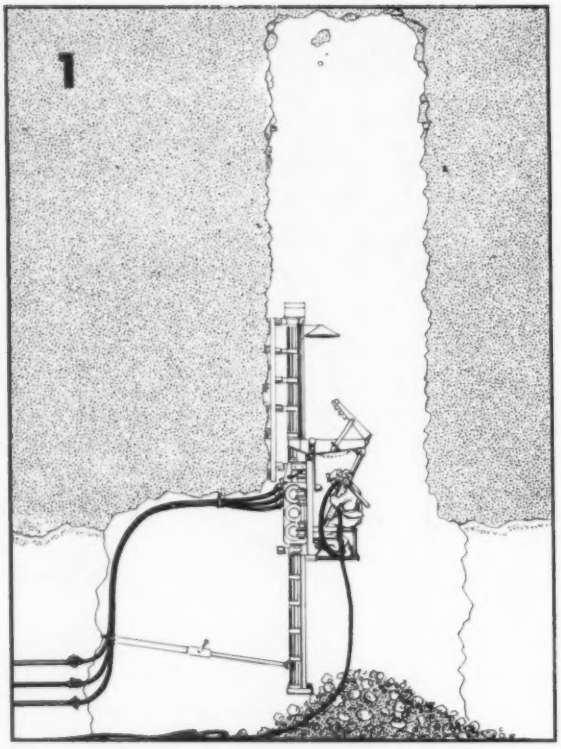
At higher pressures, increased compressor and machine repair costs and broken steel costs far exceeed advantage of faster drilling. END

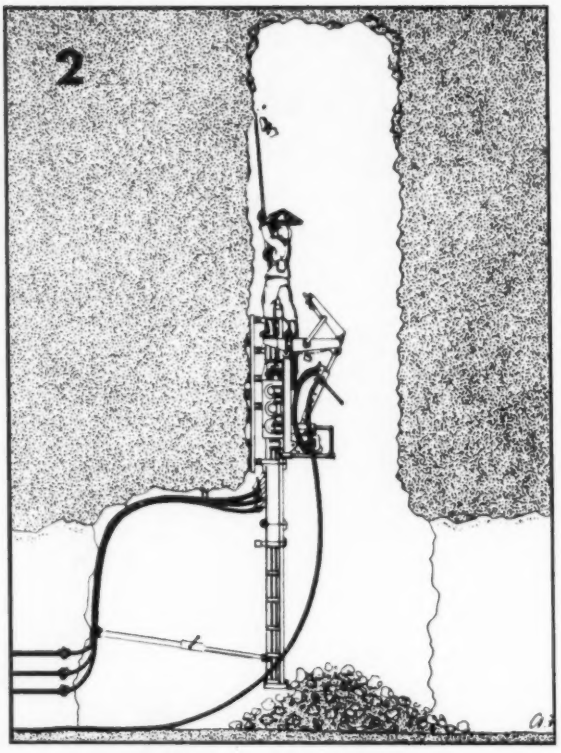
How To Make-Up Drill Steel

1. Steel is cut to length from 20-foot bars.
2. The bit end is then ground to within 1/16-inch of the final taper size with a McGee-Hogan grinder.
3. The first 6 inches of the bit end is heated to approximately 1,950° F. in an oil fired furnace.
4. The heated steel is removed from furnace, placed in forging die, and shaped to final tapered size in steel sharpening machine.
5. The steel is slow-cooled in mica for 14 to 16 hours.
6. Steel is normalized by reheating to 1,600° F. with a 5 to 6 inch overlap beyond the previous heat end limit.
7. Next the steel is air cooled at room temperature.
8. The steel is tempered and drawn at 525° F. in a salt bath.
9. Final cooling is done at room temperature.



BURN CUT holes are blasted first in raise before timber chute is built. Slab holes shot last don't break timber.





How To Use New Swedish Platform for

By Kurt Gustafsson, staff mining engineer, Research and Development

1. Ride Platform Up Raise

The Kiruna iron ore mining firm in Sweden and 15 other Scandinavian mining companies are driving untimbered inclined and vertical raises to heights of 450 feet very easily using a new Swedish raise climbing machine.

They are drving raises safer, faster, and cheaper with the Alimank-Verken, Skelleftea, climber. At Kiruna, raise footage per miner per shift has been increased from 3.1 to 4.7; shift footages of 6.2 per man are not uncommon in rock that breaks fairly easily.

The compressed air or electric driven raise climbing machine traverses the raise on a special rack or guide rock bolted to the wall. It climbs the raise at a speed of 33 feet per minute carrying the miner, stoper, drill steel etc. with a maximum load of about 600 pounds.

The guide incorporates four 1¼-inch air and water pipes so there are no separate pipe lines to install. These pipes are protected against blast damage by the guide's steel frame.

The diagram above shows the miner riding to the top of the raise after a round has been blasted. Note how the drift back had to be excavated at left of raise to provide room for a station into which the platform is swung out of the raise to prevent blast damage.

Many Swedish mines using off track mining mount the platform on rubber tires for easy transport between raises. The first two rounds are then drilled from rubber tired mounting before the guide is rock bolted in place. Note how the lowermost guide is held by an extension bar.

2. Bar Down Extend Guide Rail

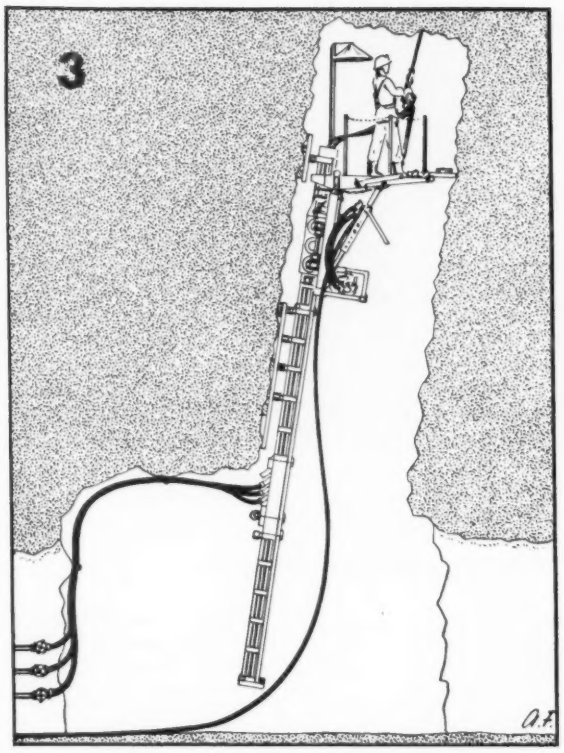
When platform reaches the top of the guide rail, the miner climbs on top of the deck and bars down all loose rock that he can reach. Note how he carefully works under the steel safety hood. The next step is to extend the guide rail by adding another length.

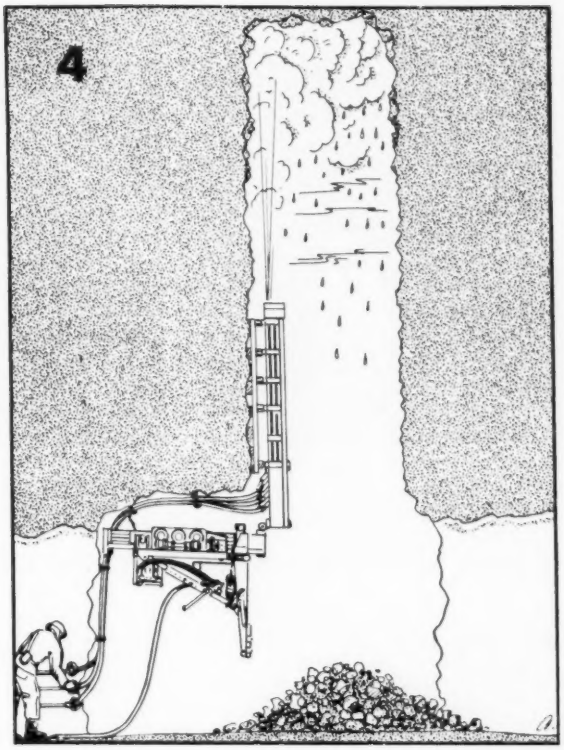
The platform is then lifted by the air motor to the top of the new guide and, working from a point closer to the back, the miner is able to scale the raise to make it safe for drilling.

The miner then lowers the platform to bottom of the raise. He next folds down the hinged section of the platform to its full size, sets the safety posts and chains in position, and loads the stoper and drill steel onto the platform. The deck is hinged back while barring down so that rock can fall freely down raise.

In case of interruption of air supply while platform is up the raise, a disc-brake and roller gear can be operated manually by the miner to lower the platform. The brake and drive gears are continuously lubricated from an oil tank built into the frame.

The air and water manifold are turned on and the miner rides to back of raise. He then drills holes in the wall of the raise and securely fastens the new guide rail in position with rock bolts. At this time great care is necessary to align and block the guide in position because only a small angle of deviation at this point means a difference of several feet in the position of the raise after it has been driven ahead a few rounds.





Fast, Low-Cost Raise Driving

Department, Luossavaara-Kiirunavaara Aktiebolog, Kiruna, Sweden

3. Drilling The Round

With the platform adjusted to the right distance from the back, the stoper is set up, short air and water hoses connected to the machine, and the miner is ready to drill the round. An automatic oiler is built into the platform ahead of the air manifold so that all that is necessary to insure stoper lubrication is to fill the platform oiler.

Note that there is adequate room for the miner to drill any type round he desires. However, by using a burn cut, a deeper round can be drilled than with a pyramid or similar cut. Deeper rounds can be drilled and blasted with no fear of blowing out or breaking timber normally used in many raises. The standard Alimank platform 5.2 by 5.2 feet is designed for driving 6- by 6-foot raises, but it is easily possible to drive larger cross sectional raises from a standard platform.

Experience at Kiruna proves that only occasionally is a guide damaged by blasting. Standard procedure is to inspect, straighten, and repair all guides after a raise is finished before they are reused in another raise.

The diagram above shows how the platform is used in driving an inclined raise. Exactly the same procedure is used as with a vertical raise. With the guide on the hanging wall, there is less damage caused by broken rock from blasting. The support legs for the deck are easily adjusted to level the deck regardless of raise angle.

It is very easy to curve the raise or change angle of inclination by fabricating and installing a special guide section conforming to angle change.

4. Blast Round Blow Out Smoke

When miner has drilled round, he disconnects hoses, lowers platform to bottom, unloads machine and steel, loads powder and primers on platform, and rides it to top of guide. The round is loaded. He then attaches the air-water sprayer to the top of the guide, opens the valves in the guide, and lowers the platform.

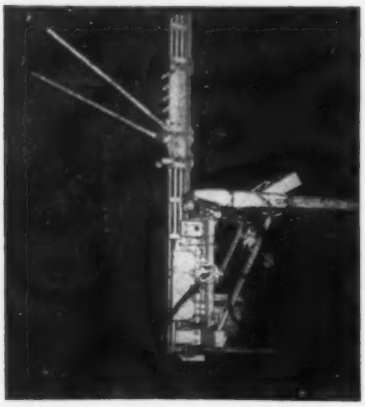
The entire raise climber is then swung back under the brow at the bottom of the raise out of the way of all falling rock. The unit is built with a hinged joint at the top of the lowermost rail. This joint connects the first and second rail section. The climber is not changed in respect to its position on the guide rail. Instead the entire lower rail is turned 90° away from the center of the raise. The rail is hung from a hook in the drift back or pulled up by an air tugger.

On the level the miner opens the air and water valves feeding the lines in the guide rain, then he blasts the round electrically.

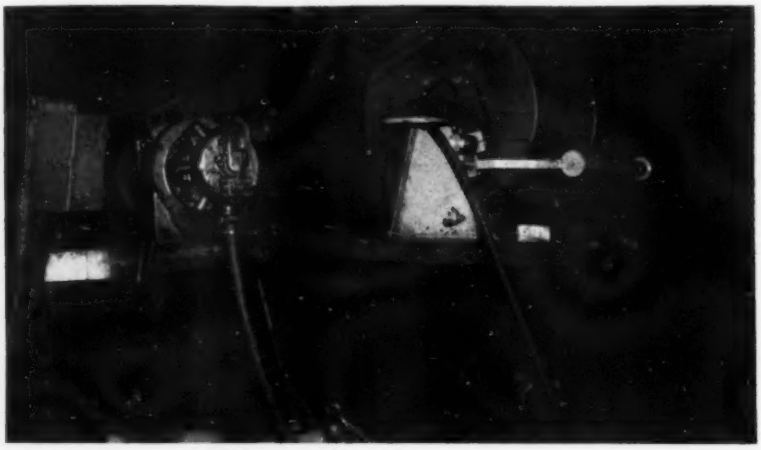
A special cap is fitted over the top of the guide just before blasting. This minimizes damage to guide. The cap also contains a mixing pipe through which air-water sprays blow out top of raise.

Experience has shown that the smoke is quickly blown out of the raise. Circulation is fast because the raise is open with no interfering timber. With the top end of guide rail so close to the back, the smoke is quickly blown down and out of raise.

This completes one cycle, and it's all done by one man.



EXTENSION LEGS at top left fasten to rock pins to hold lower part of guide in place and line.



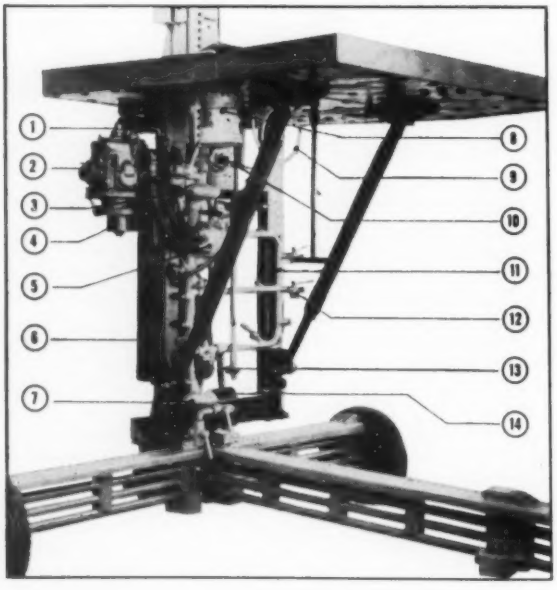
AUXILIARY EQUIPMENT includes an air tugger, left, and an air hose reel. The tugger is used to raise the hinged lowermost guide and platform out of the way of blasted rock. Air hose supplies driving motor.

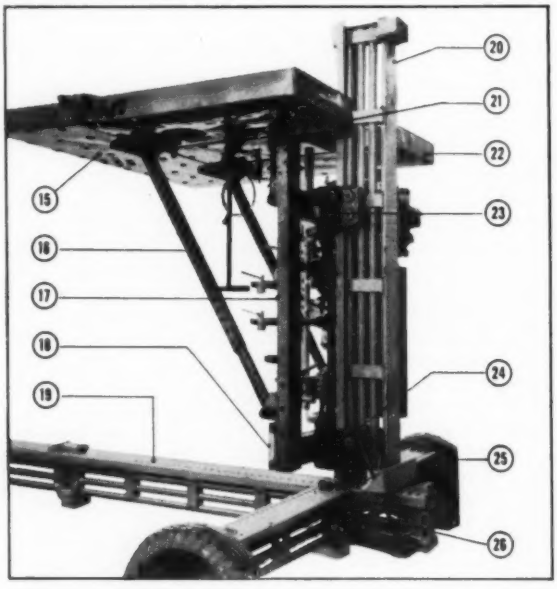
Miner Has Complete Control of Platform Movement

The only way the platform can be moved is by the miner who operates the controls to raise or lower the unit. Irreversible worm gear drives and the disc brake make it impossible for the platform to drop down the raise if the air or electric power supply is cut off.

Traction machinery consists of three worm gears connected in series and having a joint driving axle. Power from air or electric motor is transferred to driving axle of the worm gear by a conical angle gear. The conical points of the worm gears are fitted with resilient clutches in order to compensate for angle changes in the guide rail joints and for dirt on the guide rail. A series of guide rail rollers direct the platform along the rack.

Details of the platform and its components are shown below. Note the rubber tired mounting of this unit as it is assembled for speedy transfer between raises. END





1. Exhaust pipe to muffler and guide rail lubricating.
2. Air motor, 6.2 horsepower.
3. Air cleaner for incoming air from the top of the guide rail.
4. Roller chain cover.
5. Two-way valve with friction brake.
6. Rack gear-drive assembly.
7. Air cleaner for incoming air from the hose reel.
8. Air driven electric light.
9. Hose from oil tank in platform.
10. Steady hook with chain.
11. Air and water manifold.
12. Valve for air to the stoper.
13. Automatic lubricator.
14. Air hose for cleaning the guide rail and the rollers.
15. The outer part of the platform.
16. Support leg, adjustable.
17. Frame.
18. Valve for the operating cage.
19. Mounting trolley (built from guide rails).
20. Bottom guide rail with extra stiffening.
21. Clamp plate.
22. Side platform with oil tank.
23. Automatic safety brake.
24. Guide roller.
25. Wheel, rubber tired.
26. Assembly bolt for incline raises.

Gold Started It

Lead and Silver Followed

Then Came Molybdenum

Now It's Uranium

Mines and Men Make Colorado Famous

During 100 years of prospecting, panning, and picking Colorado miners have produced $8,000,000,000 worth of metals and non-metallic minerals.

Hundreds of miles of shafts have been sunk, tens of thousands of miles of drifts and adits driven, and over a 1,000,000,000 tons of ore mined, more than 125,000,000 tons of it at Climax alone. It hasn't all been high tonnage, low-grade production either, as evidenced by the specimen gold ore mined at Summitville by Pickens and Wiley, the free gold worth millions from Leadville's Little Jonny, or the famous Cresson Vug (Jewelry Shop).

Great personal fortunes have come to many a Colorado miner, others made their fortune in developments for the good and benefit of all mankind as catalogued in the special equipment chapter of this issue. Still others keep on digging to the tune of 15,000,000 tons a year. They are the epitome of mining today—from the skilled engineer to the next round, rags-to-riches, small mine operator.

As Charles B. Henderson wrote in *Mining in Colorado*, "The Surface has been well scratched and even intensely perforated with holes ranging from 10 to 3,000 feet in depth, and with tunnels as much as five miles in length." Even after all this digging, the second 100 years of mining which we now enter will see untold riches produced from mines still undiscovered and metals which are only a name on the periodic table in the chemistry class at the Colorado School of Mines.

Never has such a small area produced so many and such a variety of metals—gold, silver, lead, zinc, copper, iron, uranium, molybdenum, manganese, tungsten, tin, cadmium, bismuth, vanadium, arsenic, beryllium, columbium and tantalum. Or as wide an array of non metallics—fluorspar, clay, sulphur, marble, feldspar, barite, gem stones, gypsum, lime, lithium, mica, perlite, pumice, salt, sulphur, and vermiculite.

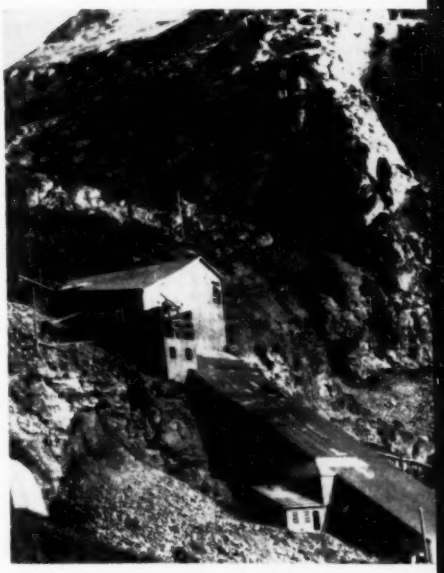
Colorado camps have been the geologist's study halls—yes, even before the famous report on the Leadville district by S. F. Simmons in 1886. To this day they are the training grounds for tomorrow's geophysical chemicalologists.

While mining has proceeded from the 4,000-foot-high valleys to the 14,000-foot peaks, all the century of drilling and blasting has pricked only the surface layer. Only in a few mines in the precipitous San Juans, and in the deepest of the so called deep shafts at Cripple Creek, has this drilling, blasting, and the determined quest for Eldorado reached depths of 3,000 feet below the surface.

As Colorado mining enters its second century it has much to look back to.

Gold Rush Started It

Colorado's first 100 years of mining started on January 7, 1859 when George A. Jackson found colors and one gold nugget in what is now Idaho Springs at the mouth of a branch of



SHRINKAGE STOPING in the San Juan's with a "Wiggle Tail", about 1910.

BLACK BEAR mill, center, long abandoned, as are the Pandora mills of

SMUGGLER UNION, bottom picture. Idarado consolidated and operates both mines.

Single and Double Jack Drilling

South Clear Creek. When he returned to his discovery in April with friends, they named the branch Chicago Creek.

Only a few miles to the north, on May 6, 1859, John Hamilton Gregory discovered the outcrop of a gold lode on North Clear Creek, near what is now Blackhawk. Thus placer and lode mining started within a few weeks of each other.

These discoveries started the world's second gold rush—Pikes Peak Or Bust—just 10 years after the 49'er rush to California. This Colorado rush drew more seekers and hangers-on than did the earlier one. In fact, the unsuccessful and disillusioned in California rushed east to join the ever-growing hordes from St. Joseph and the other not-so-far-away Missouri River cities.

While this was the first Colorado rush, it wasn't the last and the uranium rush of 1952 will be long remembered. There have been other notable and, for many, quite successful rushes in between. The California Gulch gold rush of 1860 to Leadville; the Argentine silver rush of 1866 above Georgetown; a stampede to the San Juans in 1874 with Golden Fleece discovered at Lake City and the Smuggler at Telluride a year later. Over the range at Silverton gold had been discovered in 1870.

In 1877 the discovery of lead carbonates started the great rush to California Gulch and the founding of Leadville, Lake County. Lake County has since produced more wealth, and the greatest number of metals of any Colorado county. The last of the precious metal rushes were to Cripple Creek for gold, and Creede for silver in 1891.

With its wide varieties of oxides, sulphides, tellurides, chlorides, sulphates, vanadates, and mixed ores of many metals, not surprising is the fact that just about every type of metallurgical process ever used has been tried in Colorado from sluicing to ion exchange. Many of these processes were developed in Colorado, too, the latest being the RIP ion exchange for uranium at the Atomic Energy Commission's Grand Junction pilot plant.

Here is a list of these processes. There are only a few alive that even remember many of the earlier ones.

Gravity methods of placer gold concentration, stamp mill-amalgamation, lead blast furnace, copper reverberatory furnace, pyritic smelting, Drummond lead furnacing, furnacing to copper matte, retort zinc smelting, zinc-oxide fuming, Wilfley tabling, salt roasting, acid leaching, gold chlorination with hydrogen sulphide precipitation, chlorination, cyanidation, bromination, roasting, flotation, magnetic separation, heavy media separation, spiral concentration, The Reed-Coolbaugh sulphating process, ion exchange, and solvent extraction.

Colorado has had more than its share of great mining districts and great mines. Any district or mine that has produced over 100,000,000 worth of metal is in this category. Lake County and Leadville lead the state with $510,000,000 worth of gold, silver, lead, zinc, and copper. Climax's molybdenum adds another $600,000,000 to the county. Cripple Creek's gold has been valued at $425,000,000. San Miguel in western Colorado is third with $210,000,000 worth of base and precious metals; uranium and vanadium add another $150,000,000. Other leading counties are: Eagle, $201,000,000, largely from New Jersey Zinc Company's zinc-silver copper ores. Montrose's $200,000,000 in radium, vanadium, and uranium is closely followed by Mesa's $150,000,000 in vanadium and uranium. San Juan's $140,000,000; Pitkin's $106,000,000 worth of silver and lead; $105,000,000 from the "Kingdom of Gilpin" and $104,500,000 from adjoining Clear Creek where the Rush to the Rockies started. Ouray falls just under The Marit at $98,500,000.

In 1874 W. H. Stevens and A. B. Wood were placering for gold in California Gulch and found a heavy black sand clogged the sluice. They found this was silver-bearing lead carbonate; prospected for, and discovered its out-

Cressen . . . "*jewelry shop gold*"

Little Jonny . . . "*free gold bonanza*"

cropping on the hillside above, and thus set the rush which made Leadville one of the world's largest lead and silver camps.

A Leadville store keeper, Horace A. W. Tabor, grubstaked the prospectors—George Hook and August Rische—with $17.00 and a promise for one third of what they found. They found enough so that Tabor's share made him a United States Senator, because the prospector with nothing but luck discovered the Little Pittsburg mine which was the foundation of his fortune.

In 1879 Meyer Guggenheim and his sons arrived in Leadville from Philadelphia where they had been in the lace importing business. With R. B. Graham, Guggenheim bought the A. Y. and Minnie mines which soon earned them $1,000 a day. In 1880 the Guggenheims built the Philadelphia smelter in Pueblo. This smelting business grew into the world-wide American Smelting and Refining Company.

Thomas F. Walsh established a pyritic smelter in Silverton. He needed silicious ore for fluxing and in the course of sampling dumps found that the Gertrude mine dump assayed $3,000 per ton in gold. Walsh purchased 103 claims and called them the Camp Bird. Walsh mined $18,000,000 worth of ore before selling to an English company which owns the mine to this day and is now planning to build a new mill.

On the fourth of July 1891 Winfield Scott Stratton, a carpenter by trade, wandered away from the frantic prospectors digging for gold on Cripple Creek's Bull Hill. On Battle Mountain he found a bold outcrop and staked the Independence and Martha Washington claims. Stratton dug into the outcrop, found rich ore, and became Cripple Creek's first millionaire.

In 1903, prospector Hugh Leal of Cresco, Nebraska discovered molybdenum on Bartlett Mountain. He didn't know what it was and the ignored and worthless molybdenum was just that until 1916 when mine development started. A new 400-ton-per-day flotation mill was placed in operation in 1918.

Uranium and radium (pitchblende) were first discovered in Colorado in 1871 by a Cornishman, Dr. Richard Pearce, on the Wood mine dump in Central City. Production from this district has been only a few tons in comparison to the tens of thousands of tons from the carnotite ores of western Colorado.

In 1898 Gordon Kimball mined the first carnotite (radium) in Colorado, 10 tons at Roc Creek in Montrose County, and shipped it to Madame Curie in France. Radium was mined until early 1920's, vanadium from 1935 to World War II, and uranium since.

Today this area is the famed Uravan Mineral Belt, source of much of the uranium used only 14 years ago for the Hiroshima bomb.

Money-mad prospectors haven't changed in this century or any other century. Mining gives one of the few real opportunities for the electrician, garage mechanic, and dentist to make his "pile." Do it himself in the most spectacular and rewarding manner in this age of "do it yourself."

The only thing that's changed is the metal sought and its uses. It's there on public lands for the finding and staking. Only the equipment has changed. Not the lure of wealth—be it gold, iron, or uranium fever.

Gone are the burro and the long tom. The pan and the pick are mere tools to check the findings of the magnetometer or Gieger. Here today are the airplane, the precession hydrogen nuclei, and the rubianic acid bottle.

There's a bright future for Colorado mining.

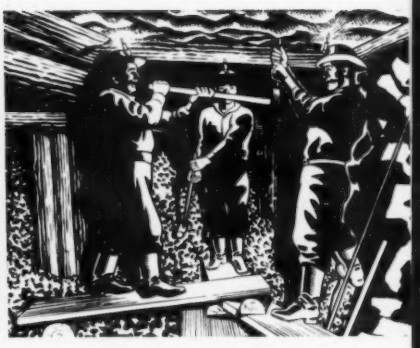
END

First Hydraulicking at Central City

Photographs used with this section of the Rush To The Rockies were supplied through the courtesy of the State Historical Society of Colorado. Many were made directly from original negatives and stereopticon slides. The earliest picture was taken about 1860 and shows placer mining at Central City.

Independence . . . ***"gold at grassroots"***

Camp Bird . . . ***"father struck it rich"***



Then . . . Manpower Drilled the Holes and Milled the Ore

Colorado Leads the Way In Mining Progress

Mining

Engineering

Metallurgy

From 1859 to 1959, from breaking ore to floating free gold, from gold panning to uranium solvent extraction plants, Colorado designed and built machinery has played a most important part in producing metals in all parts of the world.

It has been truthfully said many times "That Colorado has contributed more to mining and milling equipment and technology than has any other state."

This equipment development has been done many times by the mine or mill operator. A better piece of equipment was needed or a new method of treating ore had to be developed. Colorado was blessed with a large number of men who had the foresight to see that better machinery could be invented or developed and furthermore had the mechanical aptitude to build machines. They had tenacity too and many built better models over a period of years until the equipment worked satisfactorily for them. News of such equipment spread and other companies wanted to buy equipment for their operations. Thus, many of the operators turned to manufacturing and set up their own companies, others gave manufacturing rights to established manufacturing firms for an interest or partnership and still others sold their rights and went on to develop another mine or build another mill. Often the new operation would lead to invention of still another piece of equipment.

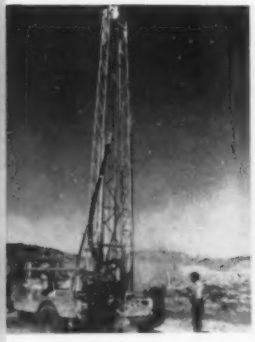
Note how closely the equipment developments have followed the tides of the mining industry. When gold was sought equipment was built to recover it. When complex sulphide ores grew in tonnage Colorado built equipment separated the minerals. When filtering of sticky gummy uranium and tungsten precipitates was virtually impossible a Colorado inventor built a better and new filter to do the job.

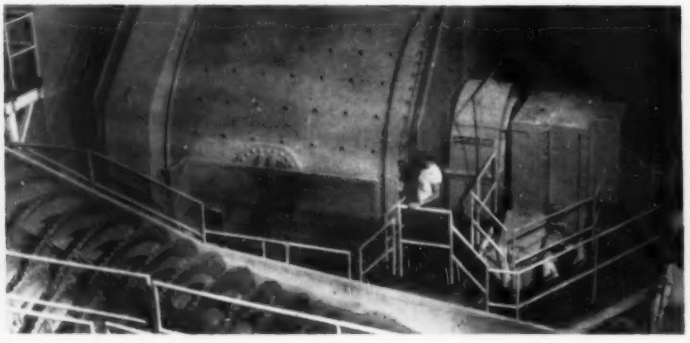
Despite its wide variety of ores and scores of great mining camps Colorado has never had a major open pit mine. It's not surprising that major equipment has therefore been invented and built for underground mining, for ore dressing, and for refining.

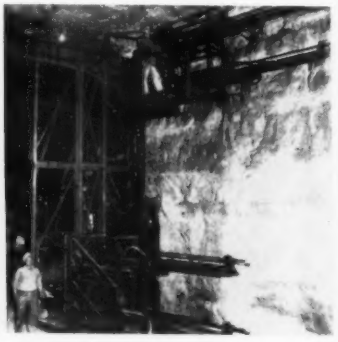
Colorado equipment has, is and will continue to set remarkable standards of performance in mining camps in every country.

It would take a large volume to catalog all the improvements and new equipment made by Colorado men in Colorado camps. Here are some of the most important of these developments. To those who have inadvertently been omitted our apologies. To those who are included our thanks for digging deeply into their files and records to furnish information and pictures for this special report.

Now . . . Machines Do the Work . . . Portadrill, Marcy Mill, Jumbo . . .







HI-CAP Explosions

Colorado Inventors Made Underground Mining a Mechanized Science

Continuous Mining

Joy Manufacturing Company
Henry W. Oliver Building,
Pittsburgh, Pennsylvania

The orange-colored metal monster, 25 feet long, snakes its way into the mine on crawler treads, its head and tail swinging right and left as it moves. The head snarls as it reaches the coal face and the cutter-bit "teeth" bite in and rip a path 30 inches wide and 18 inches deep in the face from floor to roof. The monster throws the coal back over its shoulder into a conveyor running its entire length. Coal flows into a waiting shuttle car—and the era of continuous mining began in February 1948.

The miner was the fulfillment of a dream. For back in the 1930's, Carson W. Smith, president and general manager of consolidated Coal & Coke Company, Denver, Colorado, was dreaming of a continuous mining method that could dig into the coal without drilling or blasting and deliver its production directly into some sort of transportation system. He pitched his dream at his next door neighbor and golf partner, Harold F. Silver, president of Silver Engineering Works, Inc. Mr. Silver was intrigued with the challenging idea, and went to work on the problem. With Carson's help, he finally overcame the complex technical difficulties presented by the project, and produced the first experimental machine in the early 1940's. The machine was placed in operation at Consolidated's Baum mine, Frederick, Colorado, a few miles north of Denver.

Twelve hundred miles East, in Franklin, Pennsylvania, a group of mining machinery engineers at the Joy Manufacturing Company were also at work on the design of a continuous mining machine. E. M. Platts, vice president in charge of sales for the company, heard about the Silver miner when he was in the Denver vicinity and stopped at the mine to see it perform. Enthused with what he saw, Mr. Platts recommended that Joy purchase the manufacturing and sales rights to the machine.

The first group of Joy continuous miners proved fully capable of successfully handling coal deposits in the eastern United States. By 1950, 64 units were in successful operation. By July, 1957, Joy had produced 456 miners, and had extended their operations into potash, gypsum, and salt and other mines all over the world.

Thus another machine which had its beginning in Colorado, has carried progress to the far corners of the earth in all phases of mining.

PORTADRILL and Mine Jumbo

The Winter-Weiss Co.
2201 Blake Street, Denver

In the late 1940's the uranium exploration boom on the Colorado Plateau meant that millions of feet of vertical surface hole would have to be drilled to discover and outline ore bodies. Many diamond, percussion, and rotary drills were in operation.

A long time Denver manufacturing firm, The Winter-Weiss Company, saw the need for additional truck mounted unitized drills using air and water as a flushing medium. The Portadrill was conceived and built for Plateau drilling.

The success of this drill led to extensive production and marketing of Portadrill equipment. Today the company and its distributors throughout the United States and Canada supply Portadrill equipment to all of the major mining areas where vertical surface holes are required for production or exploration.

An allied product is the Winter Weiss mine jumbo, for underground room and pillar operations. This equipment was originally designed and manufactured for the U. S. Bureau of Mines experimental oil shale mine at Rifle, Colorado. These jumbos are now in use throughout the United States where large drilling patterns are needed.

Diesel Mine Locomotives

The Ruth Company
Denver

A Denver built Ruth Company locomotive using a Diesel engine as a power source was the first piece of Dieselized equipment used in a hard rock mine in the United States. This was only 17 years ago. The locomotive was shipped to Wyoming which was the first state to permit the use of Diesel power underground; Colorado was the second.

However, Ruth mine locomotives built in Colorado from 1932 to 1942 found wide acceptance in foreign metal mines; particularly in the Baguio gold district of the Philippine Islands where many Colorado raised and trained engineers held management positions.

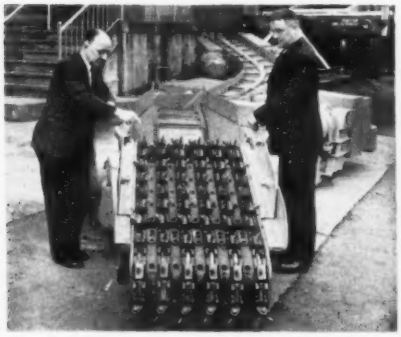
The Ruth Company has also developed the MRX-10 Diesel exhaust gas conditioner for removing all of the toxic oxides of nitrogen from the exhaust fumes using water and calcium carbonate.

Metallic Fabric Lagging and Left Hand Rock Bolts

Colorado Fuel and Iron Corporation
Box 1920, Denver

During, and after World War II as labor and mining costs increased an old method of ground support—rock bolting—was revived at many mines outside and inside Colorado. Bolting cut down on the costly installation of timber, but in several mines the problem of rock spalling between bolts continued. Engineers for the CFandI Company in connection with mine

Joy Continuous Miner, CF&I Metal Fabric, and Ruth Locomotive



Colorado's Contribution to Mining

operators conceived the idea and developed the use for chain link fabric for use as a type of lagging between bolts. From the molybdenum mine of Colorado to the iron mines of Michigan, and the uranium mines of New Mexico this use has spread.

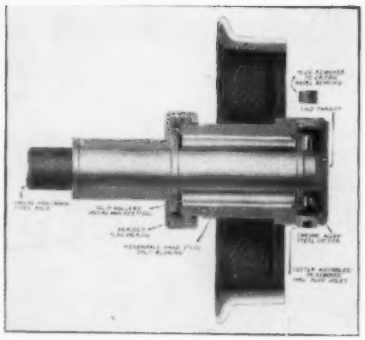
At the same time, it was in 1955, a faster and simpler method of tightening rock bolts to hold this fabric was developed. This was the application of left hand threads for expansion type rock bolts and shells.

Hammer Type Rock Drills

Ingersoll-Rand Company
11 Broadway, New York, New York

In 1871, Simon Ingersoll obtained patents on a rock drill and a universal tripod mounting. He formed the Ingersoll Rock Drill Company in New York to market these patents. Henry C. Sergeant designed the Eclipse valve for rock drills. On a trip to Colorado in 1883 he found a way to make a better valve action. In 1886 the Ingersoll and Sergeant firms merged. In the late 1890's interest in rock drilling again turned to Colorado where John George Leyner had perfected hammer drills with hollow steel. In 1894 and 1898 they were used in driving the Newhouse Tunnel at Idaho Springs, Colorado. In addition to the all important hammering principle and the use of hollow steel Leyners' drill introduced such improvements as automatic rifle bar rotation of the drill steel chuck, automatic lubrication, and inclosed throttle control. These inventions increased the speed of drilling action from 300 to 1,800 blows per minute while reducing the size of the machine to the point that one man could handle it.

In 1912 Ingersoll-Rand purchased the Leyner patents. Leyner and the term "water Leyner" have long been synonymous with a horizontal drifting or drilling machine.



Roller Bearing Mine Car Wheels

C. S. Card Iron Works Company
2501 West 16th Avenue, Denver

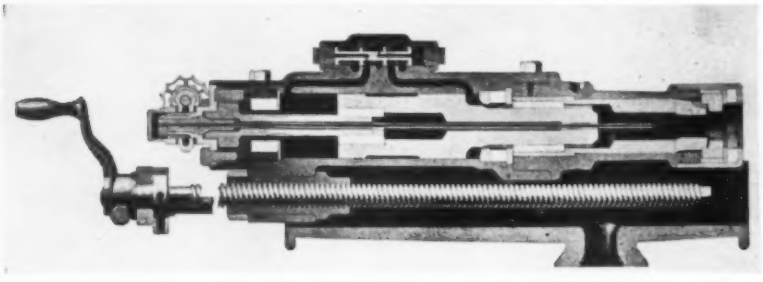
What is now the Card Iron Works was founded in 1892 to repair mine and other machinery. While repairing a steam engine at a coal mine Mr. C. S. Card must have seen the need for a type of mine car wheel bearing that offered less frictional resistance than the then widely used plain bearing wheels.

The wheel bearing initially developed was a straight roller bearing with the wheel hub as the outer race and the axle as the inner race. The rollers were retained in the wheel hub by washers on each end of the hub.

Success in selling roller bearing wheels led to rapid growth into mine car building and the Company was formed.

The improved design besides incorporating a solid hub cap included a removable split steel bushing in the wheel hub for the outer bearing race and a felt seal on the inner wheel hub. The patent also covered a method of placing the outer bearing washer in the wheel hub core so that the wheel casting could be poured around it, thus providing a practical method of utilizing the solid cap wheel design with a straight roller bearing.

The use of the "Card" improved roller bearing trucks then subsequently led to the acceptance of precision bearing in mine car wheels. So it can properly be credited for leading the way to the use of multiple car trains and highly mechanized mining operations.



HI-CAP Explosions

DuPont Explosives
Wilmington 98, Delaware

DuPont black powder, dynamite, Nitramon and other explosives have always been used by Colorado's miners. And Colorado uranium mines have been testing grounds for a series of new explosives so that, in effect, Colorado miners have helped develop them. These are the HI-CAP grades which have a high stick count, yield excellent fragmentation, and have a good fume rating. Most importantly these explosives are low in cost yet have proved practical in breaking both hard vein quartz as well as softer more rubbery uranium bearing sandstone.

Universal Air Trammers

Hack Engineering Company
124 Wazee Market Street, Denver

Small mine operators long sought a very low cost mechanical trammer to replace the dependable mule or the back breaking and expensive work of hand tramming.

In 1946, Universal Dredge Manufacturing Company, a Hack subsidiary built several model trammers in an attempt to achieve trouble free economical low cost equipment for the small mine.

Efforts soon turned to building an air locomotive to use regular compressed air.

The first units built used the Stanley Steamer engine. They were tried in the Cripple Creek district and the results were quite surprising. After one year of operation, the data obtained was evolved into new designs. It was evident that a commercial engine would have to be used as the Stanley Steamer engine availability was very limited. It was decided to use a four cylinder commercial piston type engine used on air on small hoists. It was found that modifications were necessary to obtain distance.

As time went on, the Universal air trammers became more popular. Shipments were made to Canada, South America, and other foreign countries as well as throughout the United States.

Build Better Machines to Concentrate

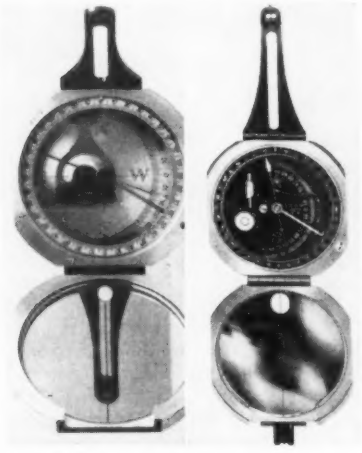
fer in mill pulps. With its original

Wagon Drill

Minerals Engineering Company
801 4th Avenue, Grand Junction.

Minerals Engineering Company pioneered portable wagon drilling in the search for uranium deposits in the Salt Wash member of the Morrison formation on the Colorado Plateau. The first units were developed about 1948.

Many improvements were made in next few years so that the newest machines incorporate cyclone sample collector, extra large compressor, and folding mast. This drill has put down more exploration footage for uranium than any other piece of equipment.



Assay Balance, Brunton Compass

William Ainsworth & Sons, Inc.
2151 Lawrence Street, Denver

In Central City in the 1870's a young watchmaker and skilled mechanic named William Ainsworth was frequently called on to repair the European-made assay balances.

After a few years of this, he decided he could make better assay balances. He did, and the company he founded is still at it. Since the first Ainsworth assay balance was built in Denver in 1879 they have been, and still are being, shipped all over the world.

The reputation for precision workmanship brought mining engineer David W. Brunton to the Ainsworth factory about 1904. He had invented and patented the now famous Brunton Pocket Transit and enlisted the Ainsworth organization to manufacture and distribute it. Since then, many thousands of these handy little instruments have been made and used by engineers in all parts of the world.

Percussion Rock Drills

Gardner-Denver Company
Quincy, Illinois

As Colorado mining celebrates its Centennial Year one of the most important suppliers of mining equipment also celebrates its Centennial.

This is the Gardner-Denver Company formed in 1927 when the Colorado firm—Denver Rock Drill Manufacturing Company—and the Gardner Governor Company merged. To this merger Denver Rock brought a complete line of percussion rock drills invented and perfected in Colorado.

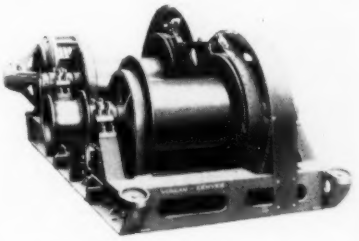
W. H. (Harry) Leonard, a Columbia University student, a stage coach driver, an early day Cripple Creek miner, a partner in the first chlorination mill at Cripple Creek, and a man of keen business foresight was instrumental in bringing compressed air drills to the mining camps of the world.

From personal experience he knew the hard work, the slowness of drilling holes for blasting. At once he was very much interested when in 1905 an inventor named Iler came to him with the idea of a new type of rock drill. The Iler rock drill was a stoper weighing about 20 pounds and was similar in appearance to a carpenter's brace. Mr. Leonard recognized the value of it and agreed to help finance the production of the drill. The first shop was a one room building in Denver. With one or two employees, an engine lathe, a drill press, a power saw, and a grinding attachment for the lathe, six Iler drills were turned out by hand.

In 1906 D. S. Waugh entered the employ of the Iler Rock Drill Manufacturing Company and designed a stoper much superior to the Iler. The Iler company went out of business and the Denver Rock Drill Manufacturing Company became its successor. The new model was called the Waugh No. 2 stoper, weighed 32 pounds, having a 1⅜ inch diameter piston hammer and an automatic valve. This drill used ⅞ inch Cruciform drill steel.

The Waugh drill was a success and new models were introduced until in 1907 the Waugh 8c Stoper was placed on the market. Weighing 55 pounds, this model was very popular with the miners in the Cripple Creek camp.

In those days, as now, the reputation of a new mining tool spread rapidly from camp to camp and in 1907 a copper company in northern Mexico ordered 36 Waugh stopers, a very substantial order.



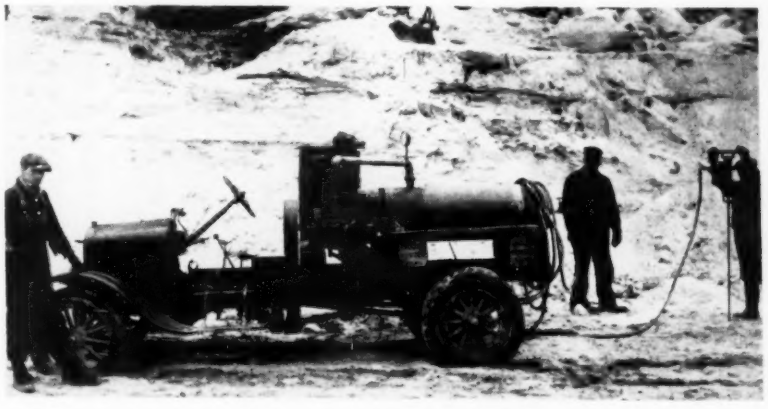
Tandem Slushers

Vulcan Iron Works Company
2960 South Fox Street, Englewood

Vulcan-Denver Iron Works Company made a number of contributions to Colorado mining practice in the hey-day of gold and silver. Even then the company was famous for mine hoists, pioneering in the use of cut gears, unbreakable frames, and peripheral clutches. Electrical drives were just coming in; welding was unknown. However, some of those 19th century Vulcan Iron Works hoists are still in service and look remarkably up to date.

Later Vulcan contributed a tandem slusher to the industry. In 1926 several 125 horsepower units were supplied to the Union Pacific Coal Company, becoming the prototype for a large number of 150 horsepower tandem slushers now in service at Climax, Colorado, and elsewhere.

Vulcan is now in the forefront of the automation of mine haulage, especially skip-hoisting.



Build Better Machines to Concentrate And Smelt all the World's Ores

Flotation Machines, Ore Testing, Packaged Cyanide Precipitation

Denver Equipment Company
1400 17th Street, Denver

The Denver Equipment Company was founded in 1927 for the prime purpose of manufacturing and marketing the Denver sub aeration (Fahrenwald) flotation machine and associated equipment. The first machine, a 6-cell No. 18, was delivered to the North London mill at Alma, Colorado for floating free gold and gold bearing sulphides.

In 1928 several of these Colorado machines were shipped to Calumet and Hecla, Inc. in Michigan for the flotation of native copper bearing ores.

In 1929 the company started commercial ore testing and offered laboratory sized beneficiation equipment to the industry. It was the first company to make mineral dressing laboratory facilities available to its customers.

DECO developed and installed the first package cyanide precipitation plant in 1932. This method employed simultaneous clarification and precipitation in consumable "sock" type filter bags.

The development of special turbine type propeller agitators in 1951 made possible handling of coarse pulps with vastly increased wearing life by the uranium industry.

Sand and Acid Pumps

A. R. Wilfley and Sons, Inc.
Box 2330, Denver

The development of the original Wilfley packingless sand pump is the classic example of how Colorado equipment was invented and perfected.

Arthur R. Wilfley, managed and operated many Colorado mills and his crusade to develop better equipment is well known. See the separate report on the Wilfley table. He had never been satisfied with any available pump for solids transfer. He therefore conceived the idea and began development of what is now the Wilfley pump in 1913. Much of the development work was carried out by Mr. Wilfley and his two sons, George F., and Elmer R. while the three of them were operating a mill treating the old Silver Lake dump in San Juan County. Not surprising is the fact that most of the mill equipment was designed and built by them. Elmer R. Wilfley is company president.

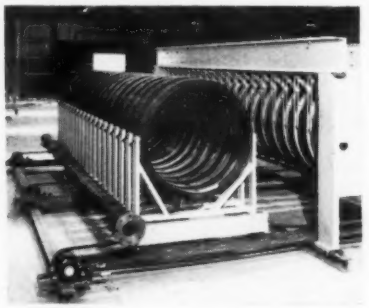
The first sand pump was marketed in 1920 and in 1922 work was begun on the design of an acid pump. This led to the development of the Wilfley acid pump which was first marketed about 1931.

Thus, this Colorado developed metallurgical product has been of great importance and value to the mineral industry. It made practical solids transfer in mill pulps. With its original packingless feature, simple construction, ease of operation, and dependability it has proved to be low cost in operation.

Mobile Tailing Disposal Unit

Telluride Iron Works Company
Durango, Colorado

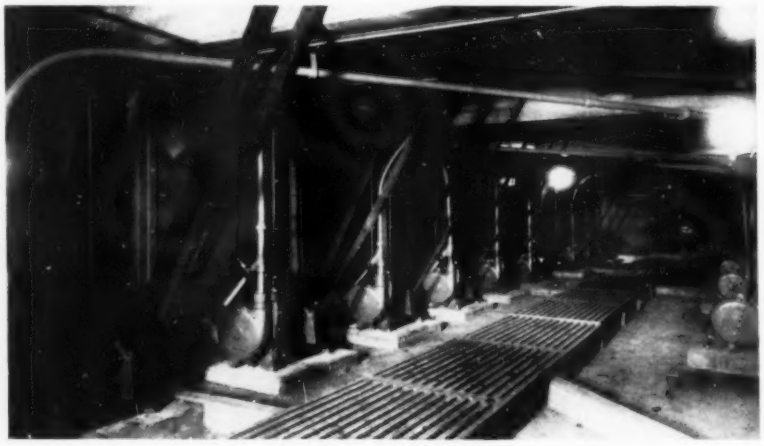
Telluride mounted a series of cyclones on a truck chassis for building tailing pond walls. The coarse sand forms the underflow which is used to build dam as the truck is moved around pond periphery. Overflow slime flows to center of pond.



Filter Press

Junction Bit & Tool Company
Box 1951, Grand Junction.

For a number of years Blair Burwell, engineer and metallurgist, sought to mechanize the standard filter press, reduce labor requirement, and improve washing efficiency. In the early 1950's he built an experimental press in the Grand Junction shop. It worked. He further developed the machine and installed the first commercial unit at the Salt Lake Tungsten Company in Salt Lake City, Utah. Immediately this filter made it possible to treat much lower grade tungsten concentrates by hydrochemical methods than had hitherto been possible. The Eimco Corporation now manufactures the units for use in mills in many parts of the world under the name of Eimco-Burwell.



Continuous Sintering

Dwight-Lloyd Division
McDowell Company, Inc.
16,300 Waterloo Road, Cleveland, Ohio.

In 1908 at the Ohio and Colorado Smelting Company in Salida, the world's first continuous sintering machine was put into operation to sinter mixed sulphide ores and concentrates. Inventors, Arthur S. Dwight and Richard L. Lloyd had worked five years to perfect this machine.

Mechanical Classifiers, Diaphragm Pumps, Agitators

Dorr-Oliver, Inc.
Stamford, Connecticut

Dorr-Oliver grew up with modern day metallurgy. In fact many of the most important Dorr equipment inventions were made in Colorado, and Colorado mills were the first in the world to use and prove the value of many of these inventions.

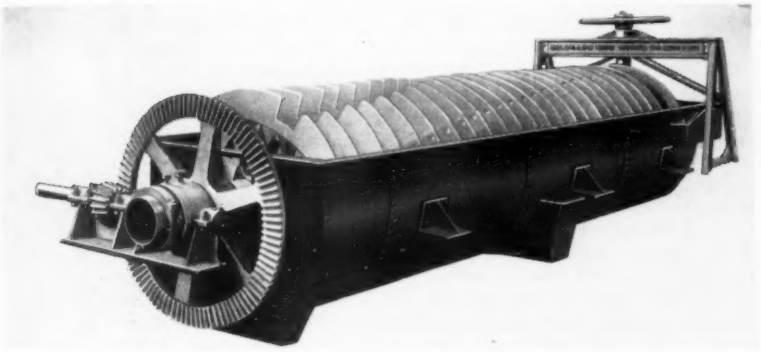
Shortly after Dr. John V. N. Dorr invented the Dorr rake classifier near Terry, South Dakota he opened an office in Denver. Dorr (now Dorr-Oliver) has been there ever since and today nearly 40 percent of all the firm's domestically manufactured metallurgical equipment is built at General Iron Works Company in Englewood, Dorr being a major General Iron stockholder.

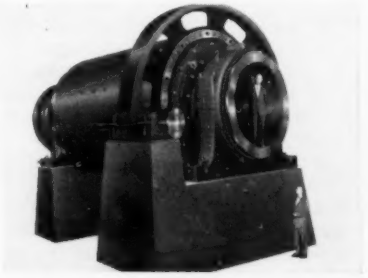
E. C. Reybold, the first employee of The Dorr Company in the Denver office, developed the Dorr diaphragm pump which was used chiefly to remove settled solids from thickeners.

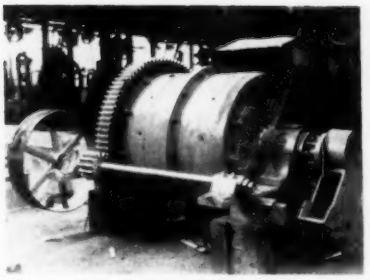
The Dorr agitator was invented by J. V. N. Dorr in 1910 and patent application filed in July, 1911. The first unit to be built was installed at the Ophir Gold Mines Company in Ophir, Colorado and operated at its cyanide plant in July, 1912. Other early installations of the agitator were at Argo Red and Ore Purchasing Company, Colorado Gold Mining and Development Company, and Liberty Bell Mining Company—all in Colorado.

The bowl classifier was developed by A. L. Bloomfield, manager of the Golden Cycle mill in Colorado about 1916. First patent was filed by Bloomfield on May 22, 1916 and the first 4 foot diameter machine was installed at Golden Cycle in August, 1916.

Colorado's Contribution to Metallurgy







Ball and Rod Mills, Classifiers, Concentrating Tables, Roasters, and Driers

Mine & Smelter Supply Company
3800 Race Street, Denver

One of the nation's largest suppliers of metallurgical equipment, The Mine & Smelter Supply Company, while only 64 years old under the present name actually traces its mining machinery manufacturing to 1860. In that year the Colorado Iron Works Company (dissolved into Mine & Smelter in 1958) set up a foundry and machine shop in Denver to make and repair mining equipment for the new but fast growing industry.

One year after founding of Mine and Smelter the first Wilfley table was made at the Wilfley mill in Kokomo, Colorado to separate and concentrate lead and zinc sulphides. The Wilfley family of inventor-metallurgists went on to new inventions and Mine & Smelter acquired the rights for manufacturing these tables in 1905. They are still made and used all over the world.

Mechanical classification started in 1904 for separating cyanide sands and slimes when J. V. N. Dorr built his first machine. A few years later, in Cripple Creek, Philip Argall adapted the Archimedes screw to classification and built several units for use in Stratton's Independence mill treating dumps.

Now universally known as the Akins classifier, the improved version of the Avoca screw classifier for that was the Cripple Creek name, has been sold by Colorado Iron and Mine & Smelter since 1908 when the first commercially manufactured units were shipped to the Shannon Copper Company at Clifton, Arizona.

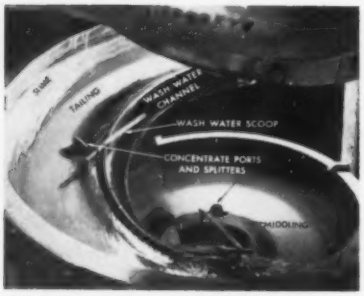
In 1907 Frank E. Marcy was employed by Mine & Smelter. About 1911 he conceived the idea of a short ball mill with a rapid change of mill content working in closed circuit with a classifier, instead of grinding in a long single pass tube mill. In 1913 the first Marcy, a 64, was sold to the Daly Judge Mining Company at Park City, Utah. It was hoped that it would replace three Huntington mills. It did too, with some capacity to spare. So began the march of the Marcys until today when 12 by 13 foot units with a 1,500 horsepower motor are used.

In 1914 Marcy started rod mill test grinding. He designed his mill for a low discharge. It worked for single pass coarse grinding more efficiently than an overflow ball mill. Today's rod mills are 12 by 16 feet in size.

Colorado Iron Works built the first Lowden drier. It was used for drying lead concentrate at Federal Lead Company's No. 4 mill. Units are still built to solve special drying problems.

During World War I, L. B. Skinner, superintendent at Western Chemical Company, invented the Skinner multiple hearth roaster for the company's pyrite roasting plant in Denver. Colorado Iron Works built the first one and added it to their line of equipment.

Colorado's Contribution to Engineering



Spiral Concentrator

Humphreys Engineering Company
910 First National Bank Building
Denver

Colorado inventor, I. B. Humphreys, first used his spiral commercially in 1943 for gravity concentration of chromite from marine sands in Coos County, Oregon.

The second important application was in ilmenite, rutile, zircon, and monazite recovery from old beach deposits near Jacksonville, Florida. The complete success of this plant led to early building of two additional plants nearby. International minerals and Chemical Corporation installed spirals at Achan, Florida in 1947 to separate phosphate from sand.

Colorado's first use was in Climax Molybdenum Company's byproduct tungsten plant in 1948. In the same year the first Mesabi iron range spiral plant was built by Cleveland-Cliffs Iron Company.

Humphreys spirals are now used in some 140 major mills and many small mills in all parts of the world recovering minerals by specific gravity.

Finest Metallurgical Clay Goods

Denver Fire Clay Company
3033 Blake Street, Denver

In 1876, Joab Otis Bosworth, already a successful pharmacist, established the Denver Fire Clay Company. He saw great opportunity to serve Colorado's young and fast-growing mining industry with assay and laboratory supply equipment. The need for metallurgical clay goods was particularly critical, since these items had to be shipped from France or England. A year to 18 months was exceptionally fast delivery for a crucible or annealing cup in those days . . . and, of course, transportation problems—pony express, stage coach, prairie schooner, and slow boats, made costs prohibitive.

After years of intensive search Bosworth discovered the highest quality clay deposits along the Colorado Front Range centering at Golden. These beds are still being mined.

From this clay, tide, fire brick, and a full line of metallurgical refractories were soon being manufactured. Other products were added to the refractory line to better serve the mining and smelting industries. Denver Fire Clay went into the manufacture of such equipment as crushers, pulverizers, furnaces, chemicals, and laboratory apparatus. The firm has many testimonials that some of this equipment is still giving good service after 50 or 60 years of hard use.

Flotation Machines

Morse Bros. Machinery Company
2900 Brighton Boulevard, Denver

Morse Bros. Machinery Company is an outgrowth of the merger of two pioneer Colorado companies, The Morse Bros. Machinery & Supply Co., and the Denver Metal & Machinery Co., both founded in 1898.

In the early years of these companies, they were mainly concerned with furnishing equipment and supplies to the Colorado mining industry, to metal mines throughout the western United States, and to the world export mining markets.

The first flotation machines manufactured by Morse Bros. were based on those developed by Professor A. J. Weinig at the Colorado School of Mines. Morse Bros. had the shop facilities and the experienced personnel to design and develop other equipment such as: thickeners, ball mills, classifiers, filters, and equipment for cyanidation plants. This equipment is used in mills in all parts of the world.

Better Designed, Better Built Mills With Colorado Engineering Know-How

Engineering Know How

Stearns-Roger Manufacturing Company
660 Bannock Street, Denver

Colorado has for many, many years maintained a very favorable reputation among mining people living in the Rocky Mountains, in other states, and in foreign countries. This esteem was due to the many rich mines and wide variety of ores discovered in the state, and the "Know-How" developed by the engineers living there. Much of this engineering know-how was passed along by them to other areas in the United States and throughout the world, either in the form of special equipment, or as efficiently engineered plants.

Stearns-Roger has specialized in such activities since 1885.

Prior to 1900, when the chlorination process was the latest development for the recovery of gold, Stearns-Roger engineered and constructed mills for such outstanding mining properties as the Portland Gold Mining Company in Colorado City, Colorado.

Soon after the turn of the century, when cyanidization superseded all other methods for the recovery of gold from ores, mills were built by Stearns-Roger for such companies as the Victor Gold Mining Company at Victor, Colorado; and the Liberty Bell Gold Mining Company at Telluride, Colorado.

All through its history, Stearns-Roger has been in the foreground for adapting new processes to the recovery of such metals as tungsten, molybdenum, vanadium, and in recent years, uranium.

In more recent years, this same combined know-how of the large corps of engineers employed by Stearns-Roger has borne fruit in such plants as the copper concentrators for the American Smelting & Refining Company at Silver Bell, Arizona; the San Manuel Copper Corporation at San Manuel, Arizona; and the Esperenza concentrator for Duval Sulphur & Potash Company at Tucson, Arizona.

During the same period, many uranium plants have been built, such as the Climax Uranium Company at Grand Junction; the Rare Metals Corporation concentrator at Tuba City, Arizona; the Texas-Zinc Minerals Corporation concentrator at Mexican Hat, Utah; and the recently completed and largest concentrator in the United States for the Kermac Nuclear Fuels Corporation at Grants, New Mexico.

The influence of this company's activities is world-wide. This is illustrated by projects such as the 30,000 ton per day copper concentrator for Southern Peru Copper Corporation at Toquepala, Peru; and ball casting facilities for South Africa.

Its manufacturing facilities located in Denver have tailor-made special equipment for many industries and each year ships such equipment to practically every state in the union and many foreign countries.

"Let's Meet in Denver"

AMC Schedules Busy Convention Program

Colorado, celebrating its Centennial during 1959, plays host to the American Mining Congress this month. Metal and mineral producers and mining equipment manufacturers will meet in Denver to discuss the industry's problems in this particularly decisive year.

Important parts of the program have been condensed for MINING WORLD readers on the next two pages. Other important Convention events include the Welcoming Luncheon, to be addressed by Colorado Governor "Steve" McNichols, and the Research Luncheon which will feature an address by David C. Minton, Jr. of Battelle Memorial Institute.

The Elitch Gardens will be the scene of the annual Miners Jamboree —always a fun night—and this one with the added attractions of amusement park rides and concessions.

Climaxing the affair is the "Speechless" Banquet; toastmaster will be Nevada's Senator Alan Bible. Entertainment and dancing will follow.

As always, the ladies are invited to attend all events. Bonus extras are planned for them, too. On Tuesday, a special sightseeing train of the Denver & Rio Grande Western Railroad will make a breathtaking trip along the foothills of the Rockies, through the Moffat Tunnel under the Continental Divide, en route to Granby and lunch at the El Monte Lodge.

On Wednesday, a preview of Fall Fashions will be presented by Neusteter's of Denver at a luncheon at the Shirley-Savoy Hotel.

Don't forget to save a few extra days for just "rubber-necking." This beautiful state with its 52, 14,000-foot mountain peaks offers many attractions for the visitor.

There are many fascinating one-day trips around Denver itself . . . visits to the summit of Mt. Evans, the nation's highest automobile highway, or to world famous Pike's Peak; through famous old mining towns like Central City and Leadville; resort centers like Colorado Springs and Aspen; Rocky Mountain National Park, Estes Park, and Grand Lake; Loveland Pass and Fremont Pass; the tombs of "Buffalo Bill" Cody and Doc Holliday; picturesque Red Rock Park and its outdoor natural amphitheater.

Join in on this "Rush to the Rockies" for a trip you'll always remember.

Special Trips for Convention Visitors

- **A tour of the U.S. Air Force Academy, followed by luncheon at the famed Garden of the Gods.**
- **Underground inspection of Climax Molybdenum's new circular shaft, as well as other parts of the mine operation, after traveling through Idaho Springs, Georgetown, and Silver Plume over Loveland Pass (11,992 feet), and on through Dillon, Frisco, and Kokomo.**
- **Ambrosia Lake and the Colorado Plateau by air. Low-level air inspection of Grand Junction area, Moab and Big Indian Basin, Monticello, Four Corners district, and Grants. Ground tour of the Anaconda Bluewater uranium mill.**
- **Visit to Colorado Fuel & Iron's steel plant and seamless pipe mill at Pueblo.**

"Mile-High-Lights"

from AMC's Denver Meeting

FRANK COOLBAUGH

E. I. RENOUARD

MINING

MONDAY P.M.—UNDERGROUND MINING

Chairman: Joseph C. Kieffer, Mgr., Northwestern Mining Dept., American Smelting & Refining Co., Wallace, Idaho

Sinking Large Circular Underground Shaft at Climax
Wm. F. Distler, Mine Supt., Climax Molybdenum Co., Climax, Colo.

Sinking a Small Concrete-Lined Shaft in Wyoming
Ken Nobs, Dist. Supt., Hidden Splendor Mining Co., Riverton, Wyo.

Mechanization in Eastern Tennessee Zinc Mines
Johnson Crawford, Asst. Mgr. of Mines, New Jersey Zinc Co., Jefferson City, Tenn.

Mining Operations of Union Carbide Nuclear Co.
James R. Borden, Mine Supt., Union Carbide Nuclear Co., Uravan, Colo.

A Review of Recent Idarado Activities
A. C. Hilander, Gen. Supt., Idarado Mining Co.

TUESDAY P.M.—UNDERGROUND MINING

Chairman: Eugene P. Reed, Mgr. of Raw Materials, Tennessee Coal & Iron Division, U. S. Steel Corp., Fairfield, Ala.

Application of Principles of Rock Mechanics to Mine Planning
John S. Rinehart, Dir. of Mining Research, Colorado School of Mines, Golden, Colo.

Mining Practices in Foreign Countries
Edward P. Leach, Gen. Mgr., Mining Div., Bethlehem Steel Co., Bethlehem, Pa.

Applications of Hydraulic Fill
John M. Suttie, Mine Supt., The Anaconda Co., Butte, Mont.

Placement and Use of Concrete Underground
Charles Pillar, Mine Supt., San Manuel Copper Corp., San Manuel, Ariz.

Roof-Bolting in Heavy Ground
Clarence N. Kravig, Mine Supt., Homestake Mining Co., Lead, S. Dak.

Yieldable Arches
Wallace E. Crandall, Chief Eng., Hecla Mining Co.

TUESDAY P.M.—OPEN PIT MINING

Chairman: Gloyd M. Wiles, Mgr., Mining Dept., National Lead Co., New York

MANAGEMENT

MONDAY A.M.—NATIONAL MINERAL POLICIES

Chairman: Raymond E. Salvati, President, AMC

What Are Our National Mineral Policies?
Hon. Elmer F. Bennett, Under Secretary, Interior
J. Roy Price, Assistant Director, Resources & Production, Office of Civil & Defense Mobilization
Hon. Thomas C. Mann, Assistant Secretary of State for Economic Affairs
Thomas R. Rawlings, Director, Barter & Stockpiling Division, U. S. Department of Agriculture
Hon. James E. Murray, U. S. Senator from Montana
Hon. Gordon Allott, U. S. Senator from Colorado
Hon. Wayne N. Aspinall, U. S. Representative from Colorado

MONDAY P.M.—STATE OF THE INDUSTRY

Chairman: Hon. Henry Dworshak, U. S. Senator, Ida.
Copper—Jean Vuillequez, Vice Pres., American Metal Climax, Inc., New York
Lead-Zinc—Charles E. Schwab, Chairman, Emergency Lead-Zinc Committee, Washington, D. C.
Light Metals—D. A. Rhoades, Pres., Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Strategic Metals—C. Hyde Lewis, Pres., New Idria Mining Co., Idria, Calif.
Industrial Minerals—Richard Foose, Dir. of Mineral Research, Stafford Research Institute, Berkeley, Calif.
Fluorspar—Clyde L. Flynn, Independent Domestic Fluorspar Producers Assn., Elizabethtown, Ill.

MILLING, METALLURGY, URANIUM

MONDAY P.M.—MILLING AND METALLURGY

Chairman: Frank W. McQuiston, Chief Metallurgist, Newmont Mining Co., New York

Transportation of Concentrates in Pipelines at International Nickel's Creighton Concentrator
D. A. Fraser, Asst. Mill. Supt., International Nickel Co. of Canada, Ltd., Copper Cliff, Ontario

Automation at the Anaconda Mill
John R. Moore, Supt. of Concentration, The Anaconda Co., Anaconda, Mont.

Application of the Krupp-Renn Process to North American Iron Ores
Max Kennard, Vice Pres., Southwestern Engineering Co., Los Angeles

Trends in Iron Ore Beneficiation
Stephen E. Erickson, Dir. of Research, M. A. Hanna Co., Hibbing, Minn.

TUESDAY A.M.—MILLING AND METALLURGY

Chairman: Harvey Mathews, Vice Pres., Stearns Roger Manufacturing Co., Denver

Application of Radioactive Isotopes in Metallurgical Research
J. Bruce Clemmer, U. S. Bureau of Mines, Salt Lake

X-Ray Analytical Methods in Process Control at Anaconda
Francis L. Holderreed, Dir. of Metallurgical Research, The Anaconda Co., Anaconda, Mont.

Flotation of Some Oxidized and Nonmetallic Ores
William C. Aitkenhead, Dir., and John A. Jaekel, Associate

O. E. POTHIER

S. E. ERICKSON

JESSE JOHNSON

WILBUR JURDEN

HARVEY MATHEWS

F. K. WILSON

Skip Hoisting at Kennecott's Nevada Mines Division
Frank Quilici, Pit Supt., Nevada Mines Div., Kennecott Copper Corp., Ruth, Nev.
Freeport's Moa Bay Nickel Project
Forbes K. Wilson, Vice Pres., Freeport Sulphur Co.

WEDNESDAY A.M.—OPEN PIT MINING

Chairman: Alfred T. Barr, Mgr., New Cornelia Branch, Phelps Dodge Corp., Ajo, Ariz.
The Bucket Wheel Excavator and Belt Conveyor—Germany's Solution to Low Cost Dirt Moving
Robert E. Kendall, Asst. Mine Supt., U. S. Borax & Chemical Corp., Boron, Calif.
Western Phosphate Mining
O. E. Pothier, Dir. of Mining Operations, J. R. Simplot Co., Pocatello, Idaho
Ammonium Nitrate Explosives
M. A. Cook, University of Utah, Salt Lake City
Large Truck Haulage at Eagle Mountain
Martin J. Hughes, Mgr., Eagle Mountain Mine, Kaiser Steel Corp., Eagle Mountain, Calif.

WEDNESDAY A.M.—SAFETY VIEWPOINTS

Chairman: Frank Coolbaugh, Pres., Climax Molybdenum Co., Div. of American Metal Climax, N. Y.
What Safety Means to the Miner
John Perkovich, Homestake Mining Co., Lead, S. D.
Getting Proper Attitudes to the Working Face
Donald E. Wilson, Div. Mine Foreman, Bunker Hill Mine, The Bunker Hill Co., Kellogg, Idaho
Administering a Safety Program
Robert A. White, Safety Supervisor, Southwest Potash Co., Carlsbad, N. Mex.
Production and Safety
R. L. Wahl, Jr., Asst. Mine Supt., Colorado Fuel & Iron Corp., Sunrise, Wyo.
Responsibility of the Management Staff
H. D. Stott, Dir. of Industrial & Personnel Relations, Calumet & Hecla, Inc., Calumet, Mich.
The Top Executive's Role
C. D. Michaelson, Gen. Mgr., Western Operations, Kennecott Copper Corp., Salt Lake City

TUESDAY A.M.—MINING EVALUATION

Chairman: E. H. Crabtree, Dir., Colorado School of Mines Research Foundation Inc., Golden, Colo.
Introductory Remarks
F. L. Smith, Mgr., Mining Div., Colorado School of Mines Research Foundation, Inc., Golden
Exploration, Geology and Ore Reserves
Speaker from E. J. Longyear Co., New York
Mine Development and Mine Operating Costs
John W. Chandler, Mining Engr., American Metal Climax, Inc., New York
Processing Development and Operating Costs
John Riddle, Metallurgical Engr., Union Carbide Nuclear Co., New York
Mine Plant and Processing Plant Construction
Wilbur Jurden, Pres., Anaconda-Jurden Assoc.

WEDNESDAY P.M.—MANAGEMENT PROBLEMS

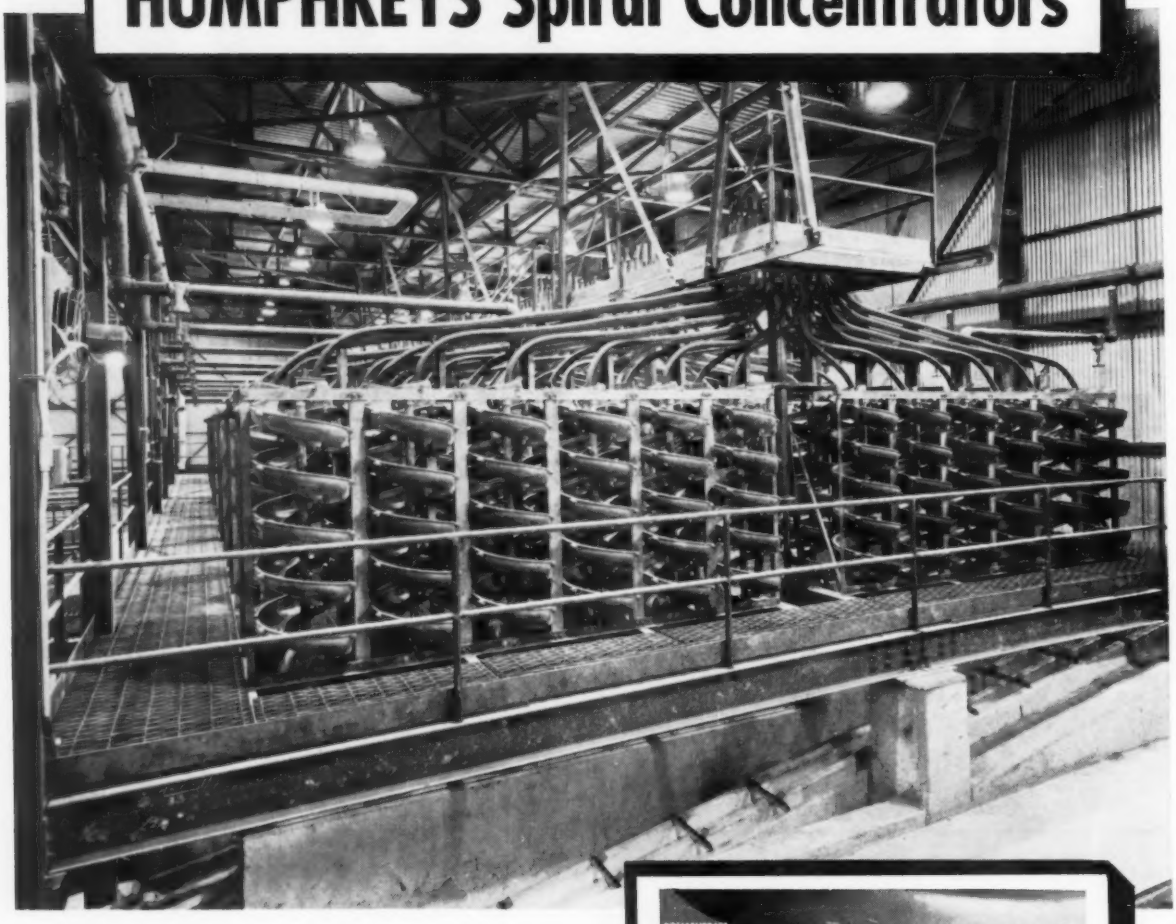
Chairman: E. I. Renouard, Vice Pres., Western Operations, The Anaconda Co., Butte, Mont.
Application of Industrial Engineering Principles
Morley H. Mathewson, Dir. of Ind. Engrg., International Minerals & Chemical Corp., Skokie, Ill.
Application of Basic Standards and Standard Costs in Iron Ore Mining
G. T. Bethune, Asst. Comptroller, Oliver Iron Mining Division, U. S. Steel Corp., Duluth, Minn.
Economics of Equipment Replacement
F. G. Kuehl, Vice Pres. of Operations, International Talc Co., Gouverneur, N. Y.
Education of the Mining Engineer
Walfrid Been, Head, Dept. of Mining Engr., Mich. College of Mining and Tech., Houghton

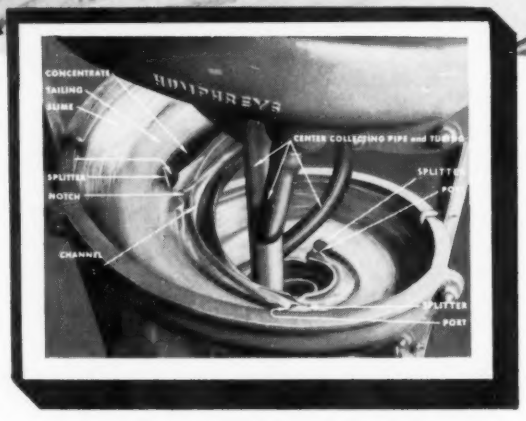
Metallurgist, Mining Experiment Station, State Univ. of Washington, Pullman
The Leach-Precipitation-Float Process at Hayden
Arthur W. Last, Chief, Ore Dressing Section, Kennecott Research Center, Salt Lake City
Performance of the Kermac Solvent Extraction Plant in the Ambrosia Lake District
Wayne C. Hazen, Senior Research Engr., Kerr-McGee Oil Industries, Denver

WEDNESDAY P.M.—URANIUM

Chairman: Dean A. McGee, Pres., Kerr-McGee Oil Industries, Inc., Oklahoma City
Current Status and Outlook for AEC Raw Materials Procurement Program
Jesse C. Johnson, Dir., Div. of Raw Materials, Atomic Energy Commission, Washington, D. C.
The Outlook for Commercial Use of Uranium
Norman A. Spector, Pres., Vitro International, A Division of Vitro Corp. of America, New York
Peaceful Uses of Nuclear Explosions
Samuel G. Lasky, Staff Assistant for Minerals, Office of the Secretary of the Interior
Procedures and Precautions in Setting Off Large Nuclear Blasts
Charles E. Violet, Lawrence Radiation Laboratory, Livermore, Calif.
Measuring and Controlling Radiation in Uranium Mills
Ralph E. Musgrove, Chief Metallurgist, Climax Uranium Co., Grand Junction, Colo.

HUMPHREYS Spiral Concentrators





This is part of the CLIMAX PLANT which will be seen during the Climax Field Trip when you attend the American Mining Congress 1959 Mining Convention, Denver, Colorado, September 14-17.

HUMPHREYS ENGINEERING CO.

910 FIRST NATIONAL BANK BLDG • DENVER 2, COLORADO

SALES AND MANUFACTURING AGENTS

AUSTRALIA:
JOHN CARRUTHERS & CO. PTY. LTD.
EDGECLIFF, N.S.W.

SOUTH AFRICA:
EDWARD L. BATEMAN LTD.
JOHANNESBURG

SWEDEN:
SALA MASKINFABRIKS A-B
SALA

SALES AGENT—ENGLAND - THE GENERAL ELECTRIC CO., LTD. (FRASER & CHALMERS ENGINEERING WORKS) ERITH, KENT

KAMOTO will be first for Union Minière's new underground program. This shaft is already over 1,000 feet deep.

Belgian Congo—

World Mining's Special Correspondent-Photographer Reports on Current Operations and New Mine Developments

Union Minière Develops New Underground Mines

Shinkolobwe U_3O_8 Ore Averages 1.0 Percent

Prince Leopold Ore Grows Zincy In Depth

To most of us, the Belgian Congo means little more than copper, with second thoughts on diamonds and uranium. Yet a wide diversity of mineral products is one of the country's outstanding features. Yields of cobalt, zinc, manganese, germanium, columbium, and beryl are all substantial and, as a surprising fact for cautious interpretation, more men are employed in the recovery of tin and gold than of all other minerals put together.

For clarity, mining activities will be reviewed under two heads—Union Minière du Haut Katanga and "the rest." In the outside group, Forminière and Beceka stand high by any reckoning.

Gem and industrial diamonds from these companies mines at Kasai and of industrials from Bakwanga still represent 60 percent of world production. Where the deposits are big, advanced forms of mechanization are now in use, such as bucket-wheel excavators on stripping and "sink-and-float" in diamond recovery.

Simple though the production of alluvial diamonds may seem, with hard rock miners and metallurgists idle and the geologists turning to Kimberlite pipes for scientific refreshment, these two companies have lively problems, quite apart from absorbing shocks from General Electric at Schenectady and Detroit. Illicit dealing is a constant menace. Tasks range from replacement of gravel reserves and production planning to those presented by the human factor. All companies of standing, under the early lead of Union Minière, devote much time and energy to native care and advancement. The term "paternalism," so commonly applied with hesitant approval, is certainly a tribute to most fathers.

Manganese has also been showing up well, in spite of the 1,000-mile railroad haul to Lobito, Angola's export harbor, and keen competition in a buyer's market. Beceka-Manganese Company at Kisenge has been enterprising in the mechanization of working places, in the methods of upgrading leaner ores, and in the electrification of plants and transport.

Tin miners are not so happy. They have had a hard struggle against difficulties, from within and without, to maintain a total yield about half that of Bolivia. Cassiterite is recovered from widely scattered sources, either in weathered pegmatites or detrital deposits. The most advanced standards are in evidence at Manono, where GEOMINES has hydroelectric power and a smelter.

From some of these deposits in equatorial areas come the **columbites** and **columbite-tantalites,** which give the Congo almost unchallenged pride of place among world producers. Associated yields of beryl—in important quantity—of wolframite and lithium (amblygonite) enrich production at many points. Most occurrences are small, using a lot of manual labor—a ratio of 1 European to 100 natives is a normal quota. A dozen companies, with a total capitalization of $35,000,000, are operating, in addition to GEOMINES. Symetain, at Kalima; Minetain; Kinoretain; Sermikat; Mirudi; Minerga; C. N. du Kivu; Belgikamines; and Miniere des Grand Lacs are prominent.

Gold mining, long established in the northeast districts, continues to yield an unvarying $13,000,000 annually, 70 percent from primary and 25 percent from alluvial deposits. Kilo-Moto Mines remains predominant.

Union Minière Develops Two New Underground

NEW HOISTING and ventilation shafts at Kambove West. Open pit in background.

Union Minière stands supreme, judged from any industrial angle. Its dividend of $37,000,000 in depressed years bears testimony to the wealth of its mineral resources. Directly or indirectly, the company produces the major part of the world's cobalt, a substantial proportion of its copper, germanium, uranium, and radium; and considerable zinc and cadmium.

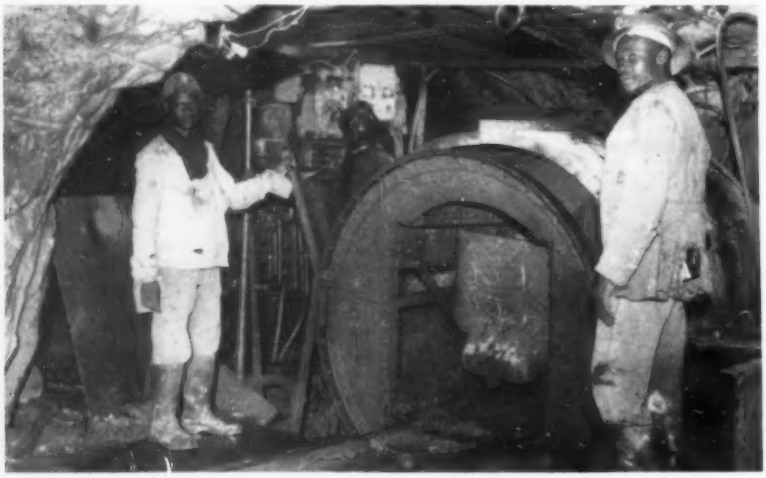
The company generates its own hydroelectric power; makes its own cement and explosives; runs flour mills for the benefit of native workers, and a coal mine for general service—all of this, with efficiency and success. Small wonder that Edgar Sengier, in Brussels, and Jules Cousin, of Elisabethville, "Presidents du Comite," have earned world fame for their administrative achievements over many

Shinkolobwe's Security Curtain Raised Slightly for This Special

SHINKOLOBWE MINE GATE where passes are necessary and cameras are barred.

When the mine was solely a producer of radium, the name of Shinkolobwe was passed in a whisper. Even today, strict surveillance is exercised by Government over the property, with cameras barred.

The ores of Kipushi and Shinkolobwe, both of unquestioned epigenetic origin and only 60 miles apart, show few common elements in evidence of kinship. It is as though some color bar were operating even in those early days against the pitch-black oxide cast into lonely segregation. The orebody lies at the same horizon in the "Serie de Mines" as the copper occurrences and dips at 70°, with a typical dimension of, say, 600 feet by 60 feet. Irregular veins or concentra-



UNDERGROUND AT PRINCE LEOPOLD showing rotary car dumper and natives.

Will Prince Leopold

Over 19,000,000 tons of copper-zinc ore, with a combined metal content of about 20 percent, have been mined since 1916. During the last 30 years, the mine has accounted for upward of 30 percent of the company's copper and for 1,000,000 tons of zinc. Flue dust recoveries of germanium and cadmium are a significant contribution to revenue. Some silver and lead are also present.

The mine lies on a fault plane bringing calcareous schists into contact with dolomitic limestone. Dipping 65 to 70°, the ore body is fairly regular, with a gradual diminution of values into the schist hanging wall and with indentations, due to replacement action, into the limestone foot wall.

For those hard, tough jobs . . . try

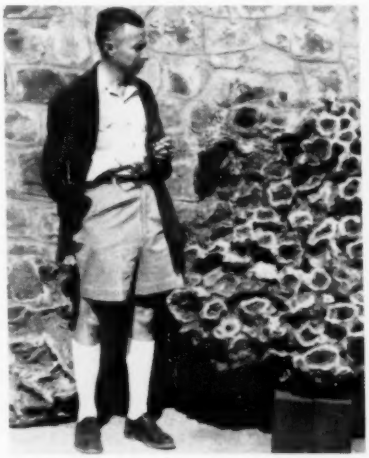
Copper Mines

years. MINING WORLD commemorated the company's Golden Jubilee with a special issue in February 1957.

The company was granted, in pioneer days, a belt of favorable ground stretching 200 miles across the map, enabling a large number of mineral deposits to be tested, worked, and exhausted, temporarily, or finally, in orderly succession; and from that opportunity have arisen geological and metallurgical problems of great complexity. Technical progress has been paralleled by the constant advancement in the social and educational standards of the native workers.

A new phase of transition to the West is actively in progress. Management gives the Kipushi mine a 10-year life, presumably not foreseeing a sudden cut-off, characteristic of some segments in the typical copper deposits, but a change in form and tenor of the orebody. Preparations for this decline have hastened the construction of the new Luilu copper-cobalt electrolytic plant near Kolwezi, half of which will be finished shortly, and the sinking of shafts at Kamoto and Kambove West for underground operations below these open pits. The great Marinel hydroelectric station (1956) is all part of the same scheme, but early timing has allowed the Northern Rhodesian copper mines to draw heavily upon it for current until relief arrives from the almost finished Kariba dam and power plant.

At present, there are only two underground mines producing in Katanga—the Prince Leopold or Kipushi, and the Shinkolobwe.



GEOLOGIST G. Derriks with fossil.

Report on Famous Uranium Mine

tions of pitchblende, with abundant cubic crystals, are clearly visible in the stopes. Some rare sulphides of nickel and cobalt are also to be seen.

The mine is still very rich, as disclosed by the yield in 1958 of 3,136 metric tons of U_3O_8 concentrates (68.5 percent) from 326,361 tons of ore or nearly 1.0 percent grade. But, there is nothing in sight to match the bright display of minerals in the stopes from 350 to 400 feet, where a barrier of fractured wall-rock had trapped the ascending solutions in a shattered zone, favorable for deposition. The Sengier-Cousins Museum at Jadotville bears colorful testimony to the glory that is past.

The mine is served by two hoisting shafts, with haulage levels 160 feet apart. Top slicing is also practiced here, with similar misgivings. Current stoping is at a depth of about 620 feet. Ore is hoisted in 20 cubic-foot cars, which are then classified to enable a fairly steady grade of ore to be fed into the mill. Great care is taken to ensure, for underground workers, immunity from the possible, though unobserved, ill effects of radiation. All workers wear film badges and their jobs are changed if readings show heavy exposure.

The Shinkolobwe mill of 30,000 tons monthly capacity was one of the first to introduce ion exchange resins into African practice. The flow-sheet is orthodox but, notably there is a heavy extraction of high-grade shipping product by hand-picking on a sorting belt and from jigs, before the ore is passed to Hardinge mills. The final tailing from the uranium plant goes to flotation for the recovery of nickel-cobalt sulphides (25 percent combined) now going to a reserve dump under present conditions.

Other small comparable uranium deposits have been found, but without the profitability. The search for another Kipushi or Shinkolobwe continues under the guidance of the geological department in Jadotville. Both these deposits have shown remarkable strength of mineralization, but immortality does not figure among the attributes of mines so rich.

Bottom at 2,400?

Top slicing has been practiced in stoping for many years with little popularity because of fire hazards. Control of grade against dilution has been good.

The mine is served by three well equipped vertical shafts. Two subvertical shafts going down to 2,400 feet will see it through. Haulage levels are 160 feet apart and bottom stopes today are at a depth of 1,600 feet. A growing ascendancy of zinc over copper has long been revealed by development and drilling—a change in relationship that still persists. For a full report on the Prince Leopold mine, see pages 51, 52, and 53 of the February 1957 issue of MINING WORLD. END.

PRINCE LEOPOLD HEADFRAMES with timber stored for top slice mining.

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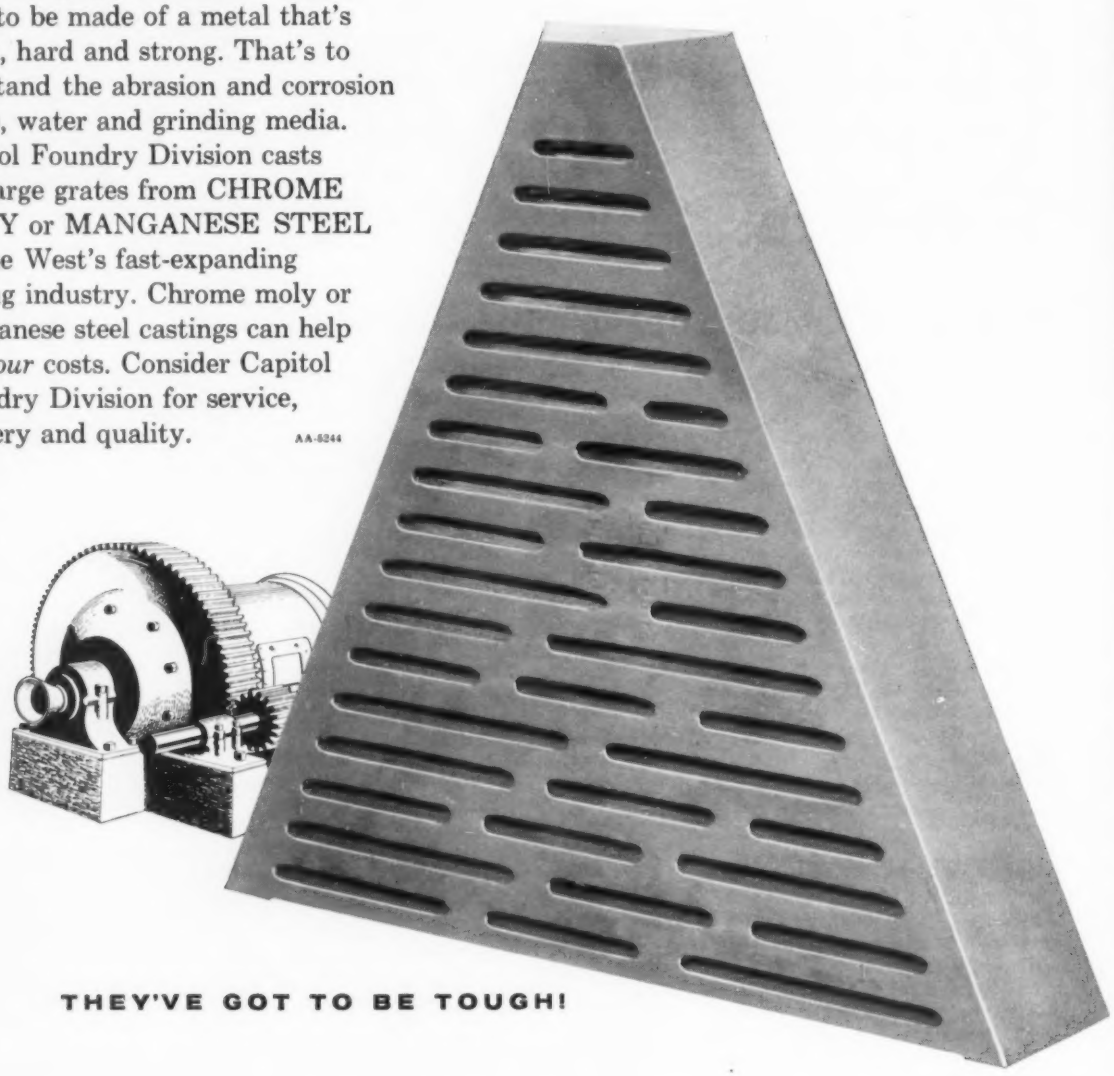

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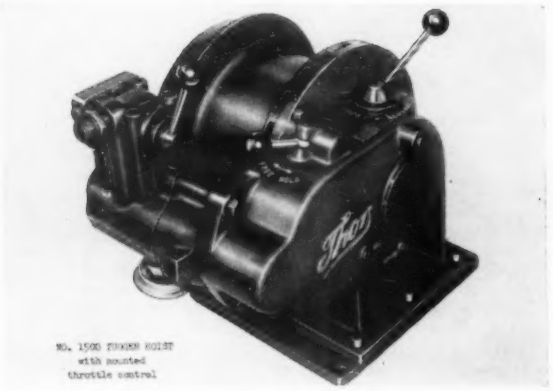
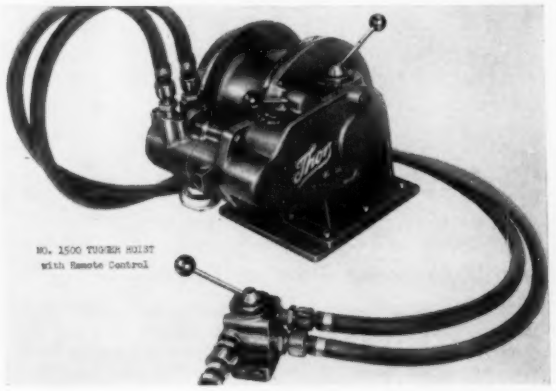
PRODUCTION EQUIPMENT PREVIEW

For data on any item on next three pages use the inquiry card opposite page 76



NO. 1500 TUGGER HOIST with mounted throttle control



NO. 1500 TUGGER HOIST with Remote Control

Air Tugger for Utility Operation on Surface and Underground

A new 1,500 pound capacity air-operated tugger hoist with extremely responsive dual control system has been developed for mining and construction applications, according to the Thor Power Tool Company. It is designed to lift, lower, and hold loads by air power, or permit free-wheeling lowering of unloaded rope. The hoist was built for operation at floor level and has wire-rope capacity of 280 feet.

The throttle control of the new No. 1500 tugger hoist is furnished standard mounted on the hoist, but can be removed and operated from a remote position by means of connecting hoses. The new utility hoist is said to incorporate such safety features as dead-man power throttle, dynamic brake for controlling free-wheeling, and mechanical load-holding lock. Thor reports that it has field tested unit extensively in both mining and construction operations. Circle No. 20.

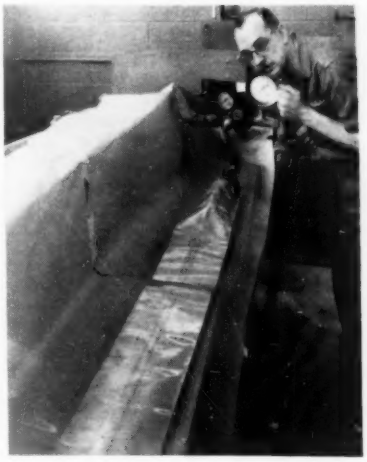
Gasoline-Powered Drill

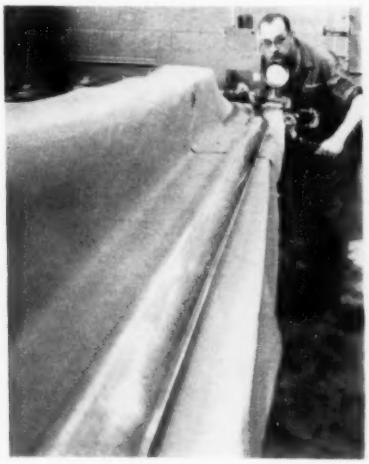
One man can operate this new Bucyrus Erie drill, which weighs 45 pounds. It is powered by a 2-cycle, air-cooled gasoline engine producing 5½ horsepower at 5,000 rpm. In shallow drilling the Winkie is said to be capable of recovering cores up to eight inches in diameter; $^{15}/_{16}$-inch cores can be recovered down to 200 feet. The drill's top rotation speed is 2,000 rpm. Unnecessary diamond wear can be reduced because all rotation is stopped automatically by a centrifugal clutch when engine speed falls below 900 rpm. Circle No. 7.

Sheet Explosives

New variety of high explosive compositions are being produced in flexible sheet form by Du Pont. The new development is said to provide a versatility and ease of handling never before possible with commercial explosives. The sheets can be cut easily with a fixed-blade knife to the right size and shape; they can be molded to fit the contours of the work, putting just the right amount of explosive in just the right place.

The explosive is designated EL-506; it is a pentaerythritol tetranitrate and is supplied in 10 by 20-inch sheets. EL-506A is waterproof, requires no wrapping, and is said to be easy to apply. Circle No. 23.





Inflate This Tubing with Air or Water at Job Site

Experimental production of light-wall seamless metal tubing will be started this fall by Calumet & Hecal Inc. The product, known as Strubing, is said to hold promise of major innovations for construction, electric power distribution, communications and many other fields. It is shipped in ribbon form to the point of use. Two major advantages listed by Calumet and Hecla: compact packaging for shipment; and for the first time thin-wall tubing is available in various materials and thicknesses at something less than prohibitive costs. Strubing could fill the need for temporary field piping for water, fuel, or compressed air. It could be used for duct work or conduit. For details Circle No. 21.

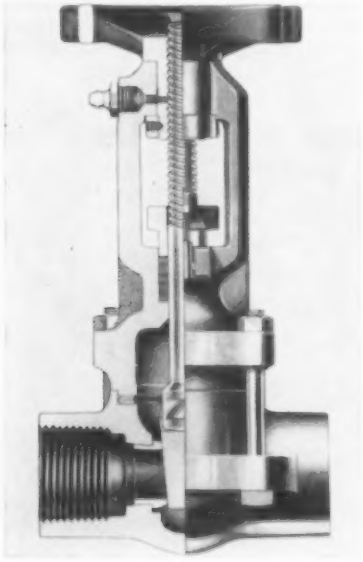
New Scale Saves Time in Laboratory

A new design features a simple graduated dial which can be turned without arresting the oil-damped balance of a new laboratory scale made by The Torsion Balance Company. Capacity of the scale is 500 grams.

Biggest advantage claimed for the balance is saving used for test work. The dial on the new Torsion Balance Co. scale is graduated from zero to 10 grams by 0.1 gram graduations. The dial is readable to 0.02 gram. Oscillation is minimized by oil damping device. The metal case has a corrosion resistant gray finish to exclude dust. It measures slightly under 12 by 7 inches. Circle No. 31.

Non-Blinding Screen Deck For Moist, Sticky Ores

New screen made by Allis Chalmers Mfg. Co. is comprised of free rolling loose rods which rotate as they vibrate. The new design is said to greatly increase production. The loose deck rods have induction hardened ends to resist wear and abrasion. They are installed at right angles to material flow in contrast to conventional fixed rod deck designs. The rods are held in place by and accurately spaced by heat-treated, alloy steel spacers. They can easily be replaced singly or in groups. Rods rotate opposite to the rotation of the vibrating mechanism at 60 to 100 rpm depending on screen throw and speed. Screen was developed specifically for sizing iron ore. Circle No. 24.



Ductile Iron Gate Valve

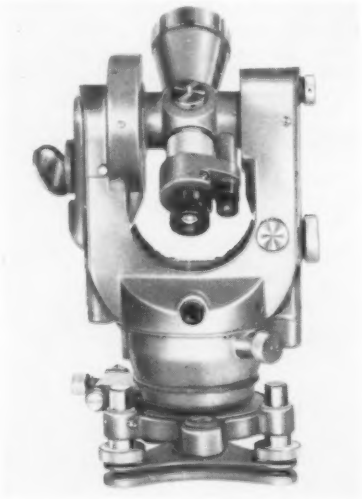
This newly designed valve is said to be the first to utilize all of ductile iron's unique properties and specific design advantages. Ductile iron possesses unusual strength and has good thermal shock and impact resistance which renders it useful for process lines. Made by Ohio Injector Company, the ductile iron gate valves come in sizes ¾-inch to 2 inches. Circle No. 64.

Tunnel Mucking Unit

Trainloader units designed by Coeur d'Alene Hardware & Foundry Company consist of a receiving car at the face end of the train, a slusher car at the rear of the train, and an optional number of intermediate, interlocking cars. A mucking machine loads the lead car, and slusher operator scrapes the muck to the rear of the train. Units are designed to hold entire round of blasted rock. Circle No. 22.

Miniature Turbocharger

Small turbocharger weighing only 24 pounds has been developed for use on the new International Harvester TD-9 tractor. It is no larger than a salad plate, and is said to boost power output of International D-282 Diesel engine by 23 percent over naturally aspirated engine. Unit was developed by AiResearch Industrial Division of The Garrett Corporation and International Harvester. Circle No. 16.



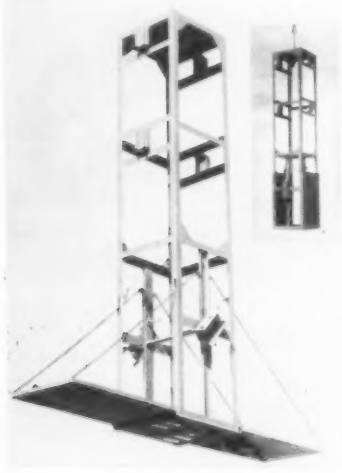
Automatic Collimation

Wild Herrburg's new optical repeating transit increases surveying speed and accuracy with a rapid reading microscope mounted next to the telescope, and an optical micrometer which allows both circles to be read directly to within 20 seconds and with easy interpolation to 10 and 5 seconds between graduations on both scales.

The T-1A has all the speed of automatic collimation setting of earlier models. Ease and speed of setting up fire assured by the optical plummet built into the alidade. Circle PEP No. 70.

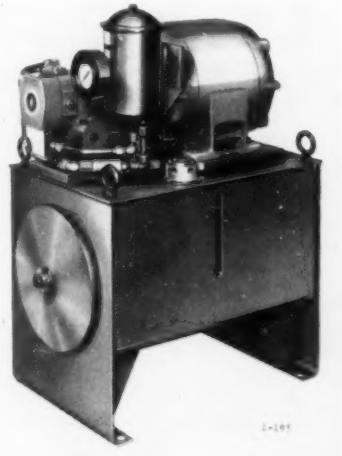
New Rear-Dump Trucks Have Corrugated Bodies

Two new International Harvester off-highway trucks are in production. They both feature new International Diesel engines. Payhauler Model 95 has a heated body, offers a struck capacity of 18 yards and a 27-ton payload. Model 65 has a struck capacity of 12.5 yards and a 19-ton payload. Both are powered by the largest Diesel engine ever built by International Harvester. The larger payhauler is equipped with a turbocharge vedrison, the DT 817, with a maximum horsepower rating of 375 at 2,100 rpm. The engine in the smaller truck is naturally aspirated and develops 250 maximum horsepower at 2,100 rpm. Corrugated bodies are said to eliminate deadweight drag. Body weight is reduced 30 percent. Circle No. 68.



New Timber Cage

With sides down, this new cage provides a large platform that permits easy mechanical surface loading of shaft and wall plate timbers. When sides are folded, the cage transports timber and miners to the working level where a crew of two men can position shaft sets, steel or frame timber safely and efficiently in a minimum of time. The Lance timber cage is produced by Machinery Center, Inc. Circle No. 25.



Hydraulic Power Package

Basic 10 gallon reservoir covers a floor area of only 25 by 14 inches. Vickers Inc., manufacturers of the unit, say it provides a convenient hydraulic power and control center for applications requiring low hydraulic horsepower. The unit is equipped with clean out covers, fluid level indicators, combination breather and filler, removable baffle and bottom drain plug. Circle No. 26.

27
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NEW DEVICE made by Joy Manufacturing Company provides protection against ground faults and short circuits on D.C.

AERIAL SURVEY COSTS can be reduced through use of Doppler radar navi-

MORE NEW EQUIPMENT . . . AND NEW LITERATURE

EARTHMOVER RIM LINES marketed by Goodyear Tire & Rubber Co. have been re-designed to make them stronger and heavier. Two new sizes have also been added. Circle No. 32.

GASKETS, seals and packing can be made from a new type of silicone rubber sheet which is about 25 percent lower in price than previous silicone sheets. Material is available from Hewitt-Robins, Inc. Circle No. 33.

NEW FOOTSPRAYER which dispenses skin-toughening solution for prevention of athlete's foot simply by stepping on a small platform is available from Onox, Inc. Circle No. 34.

LOCOMOTIVES driven by gasoline or Diesel engines are described in a new 8-page folder by Plymouth Locomotive Division, The Fate-Root-Heath Co. Specifications are included. Circle No. 35.

TIRE MAINTENANCE for off-highway equipment can be simplified by a new line of hand tools introduced by Dill Manufacturing Company. Kit includes valve cap tool, valve stem refacer, rethreaders, and reseaters, etc. Circle No. 36.

INSTRUMENTATION, equipment, systems and controls for the Process Industries are covered in a bulletin announced by B-I-F Industries, Inc. Circle No. 37.

ROTARY DRILLS made by Stardrill-Keystone Company are described in an 8-page bulletin. Included is the model 40-BH designed primarily as a blasthole machine. Circle No. 38.

SHUTTLECAR bulletin on National Miner Service Company's AC or DC driven Torkar models contains comprehensive specifications and technical information. Circle No. 39.

NEW MINE FAN and circuit breaker monitoring and control system is fully explained in Bulletin 5902 by Femco, Inc. It provides centralized remote control for circuit breakers. Circle No. 40.

YELLOW BRATTICE CLOTH is now available from American Brattice Cloth Corp. at no extra charge. Company has developed drying process which is in line with safety trend toward use of brighter, more visible colors underground. Circle No. 63.

LOWBOWL SCRAPER and new Caterpillar 225-horsepower wheel tractor are described in a bulletin which covers the significant operating features of the equipment. Circle No. 65.

COLOR MICROSCOPY can be an invaluable preliminary to reagent test work by revealing the degree of mineral locking, dissemination, oxidation and tarnish of an ore says American Cyanamid Company. Mineral Dressing Notes No. 25 explains techniques. Circle No. 9.

FOR MILL CONTROL, a new unit is available which senses position of materials, controls equipment, signals equipment failure and applies corrective measures. It's called Transist-O-Trol and is made by Industrial Physics & Electronics Company. Circle No. 10.

AIR DUMP CARS made by Magor Car Corporation feature low height, open body. Manufacturer claims performance records prove cost of replacement parts furnished by Magor equals less than 0.1 percent of the purchase price per car. Circle No. 11.

KOEHRING CRAWLER model 205 is described in a new 16-page bulletin. The machine is convertible to a ¾-yard shovel and hoe, a crane, a ¾-yard dragline and a ¾-yard clamshell. Circle No. 12.

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MINE LOCOMOTIVES can now be "tandemized" by new service offered by General Electric Company. Old two axle motors can be converted at GE service shops or by "do it yourself" kits. Circle No. 41.

SLACKLINE CABLEWAYS: Eight torque converter-equipped installations are described by brochure TC-1. It's available from Sauerman Bros., Inc., Dept. M-33, 638 S. 28th Ave., Bellwood, Ill. Circle No. 42.

TY-ROCK SCREENS which are described as full floating, high-speed and circle throw, are outlined in a comprehensive manner in catalog 68 by The W. S. Tyler Company. Circle No. 43.

TWIN DRIVE FOR SCRAPERS are now available on Euclid model TS-24 units. Power is provided by two General Motors Diesels with a total of 563 horsepower; tractor is driven by 336 hp. engine and a 227 hp. Diesel is mounted at the rear to drive scraper wheels. Circle No. 54.

NEW DEVICE made by Joy Manufacturing Company provides protection against ground faults and short circuits on D.C. operated off-track mining machines and trailing cables. Circle No. 14.

SUBMERSIBLE PUMP: Specifications and details on heavy duty, electric submersible pump are available in a folder published by Stenberg Manufacturing Corporation. Circle No. 15.

CLEAN AIR for one line respirator or one line hood is the subject of a new bulletin from Mine Safety Appliances Company. The bulletin describes the M-S-A diaphragm type air compressor. Circle No. 61.

MAGNETIC MEDIA RECOVERY for sink-float systems with a new wet drum separator is the subject of a bulletin by Stearns Magnetic Products. New separator utilizes ceramic magnet material which has permitted designer to achieve an ideal magnetic pole structure. Circle No. 48.

AERIAL SURVEY COSTS can be reduced through use of Doppler radar navigational system says Fairchild Aerial Surveys, Inc. The equipment automatically determines ground speed and drift angle of aircraft, and an electric brain computes the aircraft position without need for ground control stations. Circle No. 58.

PRIMACORD offers these advantages for blasting according to Coast Manufacturing Company: Complete detonation—no unexploded caps or powder; contacts every cartridge, even in deck loads; and better efficiency. Circle No. 59.

ATLAS TRAMMER built for multi-level operation, can be hoisted on a 48-inch cage. Details of this 1½-ton Type J battery locomotive are contained in bulletins 1293 and 1294. Circle No. 1.

OPTICAL TRANSIT: New bulletin T-16 outlines advantages of Wild Heerbrug Instruments, Inc. transit, which the manufacturer claims is faster, more accurate and easier to work with than any other survey instrument in its price range. Circle No. 3.

SCRAPERS for underground slusher installations are described in a new bulletin No. 287, available from Alloy Steel & Metals Company. Circle No. 5.

SECONDARY CRUSHERS featuring self-tightening bell head, curved concaves of manganese steel and patented dust seal on the lubrication chamber are described in Bulletin No. 8112 by Traylor Engineering Co. Circle No. 6.

WORN STEEL can be re-built 15 to 50 percent faster with Stoody Co. iron powder coating, according to the manufacturer. For details Circle No. 8.

BLOCKS AND SHEAVES are outlined in a new catalog by Sauerman Bros. Inc. Catalog contains complete specifications, including tonnage capacities and recommended wire rope sizes. It is available from the company at 638 S. 28th Avenue, Bellwood, Ill. Circle No. 55.

MERCURY PRESSURE GAUGES of new design feature interchangeability and permanent accuracy, according to Meriam Instrument Company. Three new gauges are now available for either static or differential pressures. Circle No. 56.

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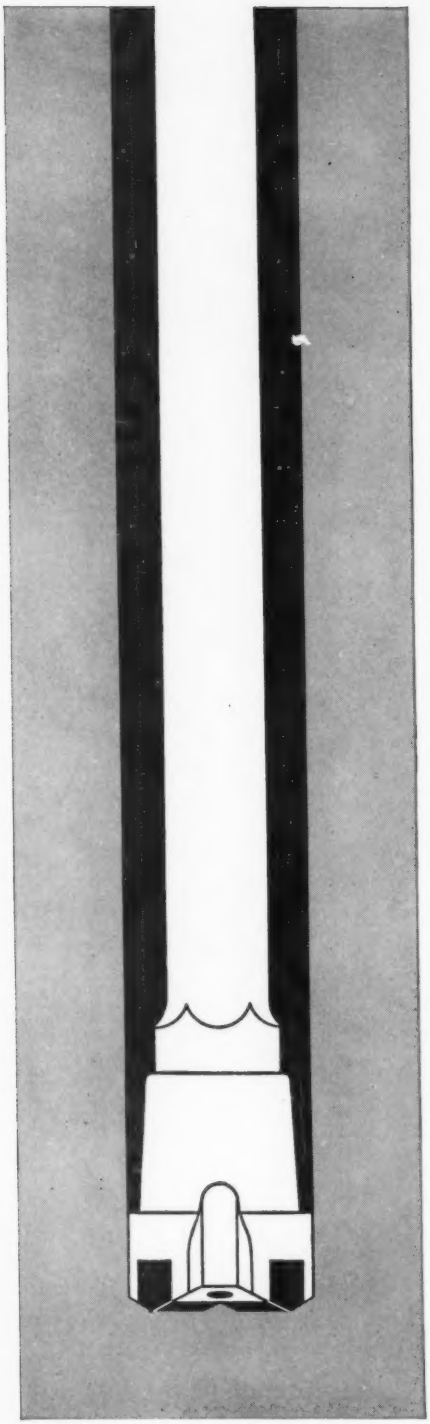


There's More Footage and Greater Economy in a Joy TC Bit

Here's why . . . Joy bit blanks are precision machined from a fine alloy steel, and a controlled heat treating process adds strength to give rugged service and long life. The carbide insert, a special grade selected for its extra footage-producing ability, is brazed to the bit blank by an exclusive process. This provides a super tough bond between the carbide and the bit blank—there's no lost time due to lost carbides.

These features, plus the excellent chipway design that provides maximum hole cleaning ability, keep Joy bits drilling longer. You get more hole per bit . . . more hole per shift . . . more production.

For proof of performance, contact your Joy representative. He will be glad to demonstrate Joy Tungsten Carbide Bits.

YOU'LL FIND YOUR BIT SIZE IN THIS CHART

SHOULDER DRIVE	BOTTOM DRIVE	TAPER SOCKET
1½"	*2½"	1¼"
1⅝"	*2¾"	1⅜"
1¾"	*3"	1½"
1⅞"	*3¼"	1⅝"
2"	*3½"	1¾"
2⅛"	*4"	
2¼"	*4½"	
2⅜"	*5"	
2½"	†4"	
2¾"	†4½"	
3"	†5½"	
*3½"	†6"	
*4"		
*4½"		

NOTE: * x-type. †Rose design Others are cross type.

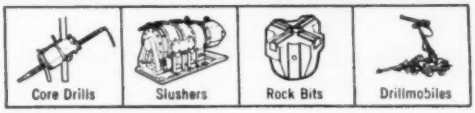
Write for Bulletin 295-8

EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY

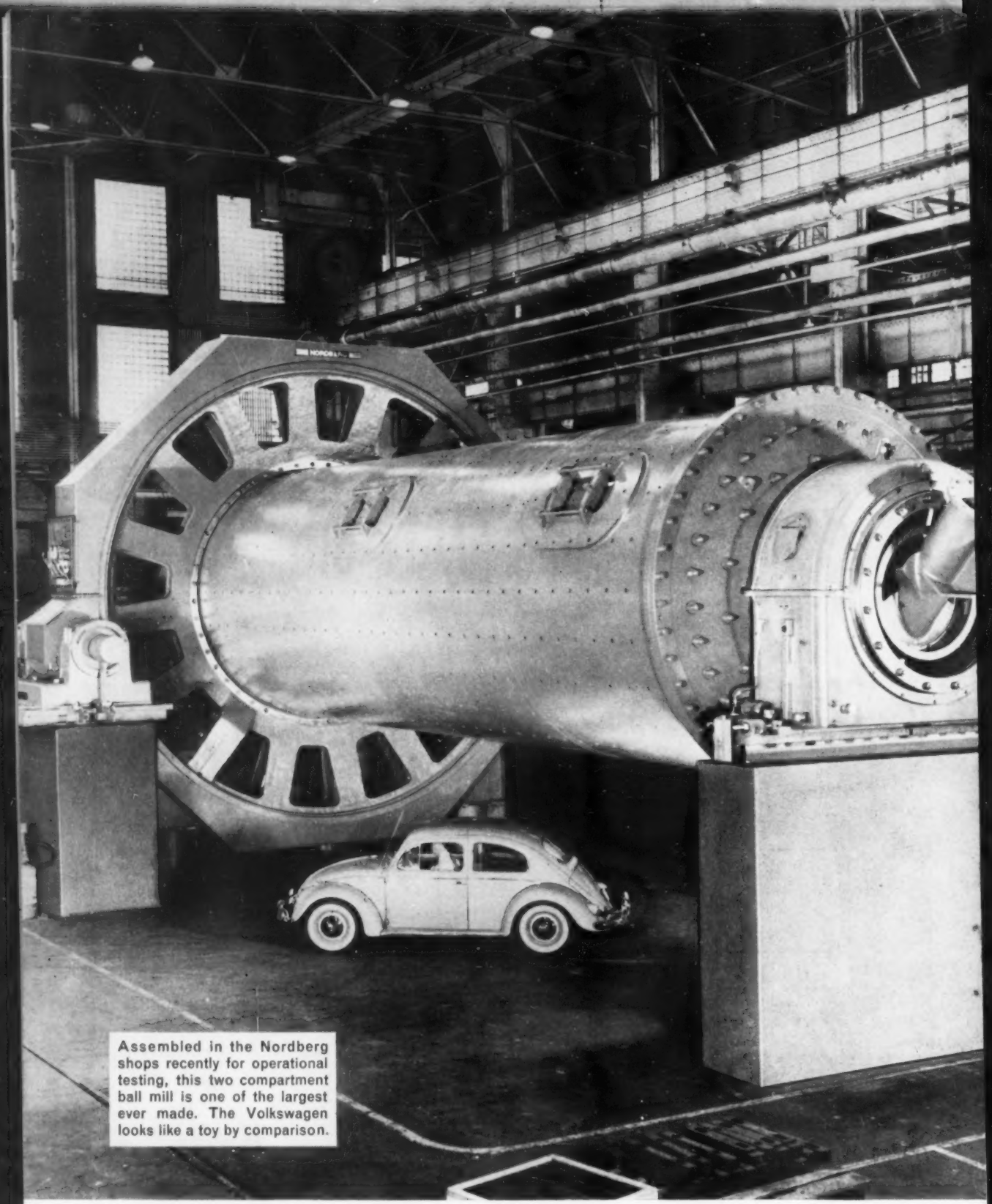
JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario



WSW M-7510-295

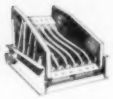


Assembled in the Nordberg shops recently for operational testing, this two compartment ball mill is one of the largest ever made. The Volkswagen looks like a toy by comparison.

SYMONS PRIMARY GYRATORY CRUSHERS

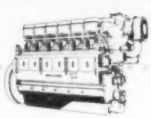
SYMONS® CONE CRUSHERS

SYMONS VIBRATING SCREENS



SYMONS VIBRATING GRIZZLIES

ROTARY KILNS and COOLERS



NORDBERG ENGINES

NORDBERG sets the pace in LARGE GRINDING MILLS

to turn out greater tonnages at lower cost per ton

Nordberg has recently completed five of the largest grinding mills ever built for industrial service. These two compartment Nordberg ball mills (see opposite page) are 12 feet in diameter by 36 feet long, each powered by a 2500 hp synchronous motor, operating at 10% beyond rating. These mills are being installed in a new 5 million barrel per year wet process cement plant. The economies of using very large grinding mills to turn out greater tonnages at lower cost are important, however, to many other large ore and mineral reduction processes, as well.

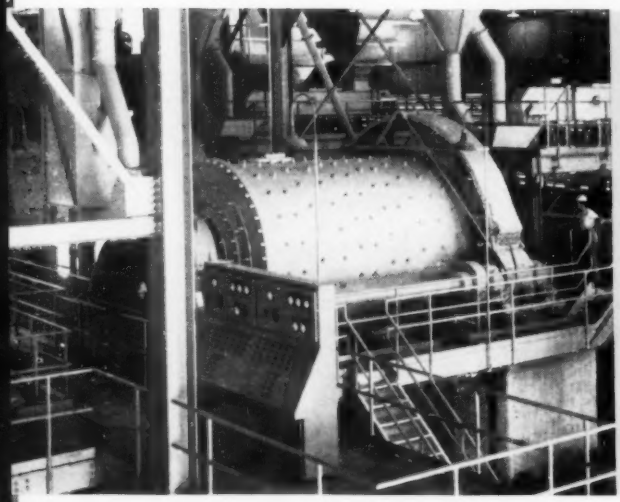
Consider some of these basic advantages:

1. *Lower construction and installation costs* . . . A single, large mill requires less floor space than several smaller ones, and only one foundation is required. Thus, construction costs are lowered and, in most cases, production is increased.

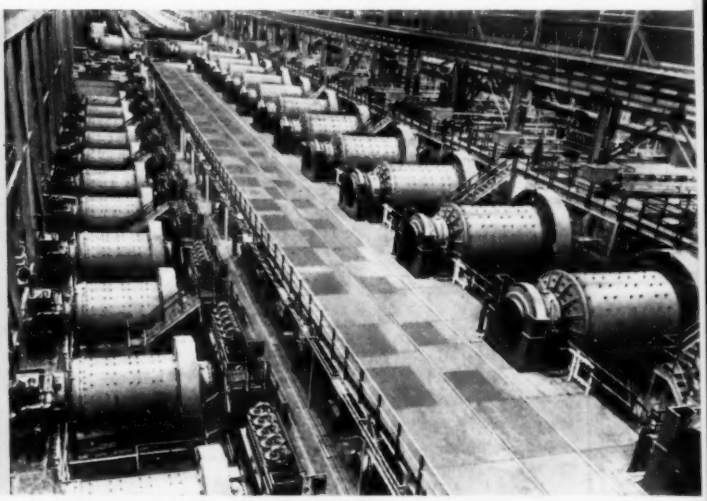
2. *Simpler automatic operation* . . . Where automatic operation is required, larger mills permit simpler handling with fewer controls. This lowers initial investment and minimizes installation and operational problems of automatic controls.

3. *Less maintenance* . . . Here, costs are again related directly to the number of mills installed. Fewer units mean less wearing parts and more dependable production. Exceptional savings may also be realized in replacement liners alone.

These are significant reasons behind the current trend toward larger grinding mills. But whether you require large or small grinding mills, you can count on the proven experience of Nordberg in furnishing the right grinding mill to meet your specific needs . . . including Rod, Ball, Pebble, Tube and Compartment types, in sizes from 6 to 13 feet in diameter and up to 50 feet in length. *Write for further information.*



Shown here are two of five 11′ x 17′ Nordberg Ball Mills—three raw and two finish—installed in a midwest cement plant that has a capacity of 3,000,000 bbl. annually.



The largest iron ore mill installation in the world with 58 Nordberg Grinding Mills. This concentrator building houses 27, 10′ x 14′ rod mills and 27, 10′ x 14′ ball mills. Four Nordberg mills serve as standby units.

NORDBERG MANUFACTURING COMPANY, Milwaukee 1, Wis.

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NORDBERG

SYMONS . . . a registered Nordberg trademark known throughout the world.

SYMONS CLASSIFIERS SCREENS NORDBERG

ATLANTA · CLEVELAND · DALLAS · DULUTH · HOUSTON · KANSAS CITY · MINNEAPOLIS · NEW ORLEANS · NEW YORK · ST. LOUIS
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MAGMA
COPPER COMPANY

Buyers of

COPPER, GOLD
AND SILVER ORES

MINES AND SMELTER AT
SUPERIOR, ARIZONA

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Smelting and Refining Co.

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from mine to consumer

buyers of

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Ores and Concentrates:

Copper Smelter—Miami, Arizona
Address: Ore Purchasing Department
International Smelting and Refining Co.
P. O. Box 1265
Miami, Arizona

Lead & Zinc Ores
and Concentrates

Lead and Lead-Zinc Smelter
Lead-Zinc Concentrator } **Tooele, Utah**

Address: Ore Purchasing Department

International Smelting and Refining Co.
818 Kearns Building
Salt Lake City, Utah

Please establish contact prior to shipment

Metal & Mineral Prices

U.S.A.

METALS

August 18, 1959

COPPER: **Electrolytic.** Delivered F.ob. cars, Valley basis (pound) 30.00¢
Lake. Delivered, destinations, USA ..... 30.00¢
Foreign. Delivered Destinations, USA ..... 30.00¢
Custom ..... 30.00¢
LEAD: **Common Grade.** New York (Per pound) ..... 12.00¢
Tri-State Concentrate, 80% lead, per ton $141.72
ZINC: **Prime Western:** F.o.b. E. St. St. Louis (Per pound) ..... 11.00¢
Prime Western: Delivered, New York ..... 11.50¢
Tri-State Concentrate, 60% zinc, per ton $64.00
ALUMINUM: **Primary 30 Pound Ingots (99% plus)** (Per pound) 26.80¢
ANTIMONY: **Lone Star Brand. F.o.b. Laredo, in bulk** (Per pound) 29.50¢
BISMUTH: (In ton lots) price per pound $2.25
CADMIUM: **Sticks and bars.** 1 to 5 ton lots Price per pound 1.30
COBALT: **97.99%,** keg of 550 pounds (Price per pound) $1.75
COLUMBIUM: **Powder** ..... Nom., per pound $55.00-$85.00
GERMANIUM: dioxide, high purity, gram ..... 18.50¢
LITHIUM: **98%** (per pound) ..... $11.00-$14.00
MAGNESIUM: **Ingots (99.8%)** F.o.b. Velasco, Texas, per pound 36.00¢
MERCURY: **Flasks.** Small lots, New York ..... $230.00-$232.00
NICKEL: **"F" Ingots (5 pounds).** F.o.b. Port Colbourne, Ontario 75.50¢
PLUTONIUM: To July 1, 1962 AEC will pay $30.00 to $40.00 per gram depending on plutonium 240 content. July 1, 1962 to June 30, 1963, per gram $30.00
SELENIUM: **99.5%, per pound** $7.00
TELLURIUM: Common grade, Per pound $2.50
THORIUM: per kilogram $43.00
TIN: **Grade A Brands.** New York (Per Pound) Prompt delivery $102.25¢
TITANIUM: **93.3%** + Grade A-1 Sponge (Per pound) $1.60
URANIUM: **Rod** (0.790 U-235) $16.00 Per Pound; Foil $16.75
U-235: **Nominal** (Per pound) $7,725
GOLD: **United States Treasury Price** ..... $35.00 per ounce
SILVER: **Newly mined domestic.** U.S. Treasury price per ounce 90.5¢
Foreign Handy Harmon ..... 91⅜¢
PLATINUM: Per ounce ..... $77.00-$80.00
ZIRCONIUM: **Sponge,** Per pound, Reactor Grade $5.00

ORES AND CONCENTRATES

BERYLLIUM ORE: **10 to 12% BeO.** F.o.b. mine, Colorado $46.00 per unit Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at $400.00 per short ton or by assaying at 8.0 to 8.9% BeO, $40 per unit; 9.0 to 9.9%, $45; over 10.0%, $48.00.
CHROME ORE: F.o.b. railroad cars eastern seaports. Dry long tons,
African (Rhodesian). 48% Cr_2O_3. 3 to 1 Ratio .... $40.00-$42.00
African (Transvaal). 48% Cr_2O_3. No ratio ..... $28.00-$30.00
Turkish, 48% CR_3O_3. 3 to 1 chrome-iron ratio .. Nominal $45.00
U.S. Government ore-purchase depot Grants Pass Oregon. Buying suspended, quota filled.
COLUMBIUM-TANTALUM ORE: Per Pound Pentoxide Nominal $1.00
IRON ORE: **Lake Superior. Per gross ton Lower Lake Ports**
Mesabi, Non Bessemer, 51.5% Fe $11.45
Mesabi, Bessemer, 51.5% Fe $11.60
Old Range Non Bessemer $11.70
Old Range Bessemer $11.85
Swedish, Atlantic Ports, 60 to 68% Fe Contracts, Per Unit 25.00¢
MANGANESE ORE: **Metallurgical grade.** 48 to 50% Mn Long ton unit ..... $1.00-$1.05
Metallurgical grade. 46 to 48% Mn. Long ton unit. .. $0.95-$1.05
Metallurgical grade. 44 to 46% Mn. Long ton unit .. $0.85-$0.90
Domestic U.S. Government. GSA Basis $2.30 per unit for 48% mn.
MOLYBDENITE CONCENTRATE: **90% MoS_2 F.o.b.** Climax, Colorado. Per pound Mo, plus container cost $1.25
TUNGSTEN CONCENTRATE: **Domestic.** 60% WO_3 Per short ton unit ..... Nominal $20.00
Foreign: 65% WO_3 Per short ton unit (Scheelite) .. Nominal $13.00
Foreign: South American, Spanish, Portuguese .... Nominal $12.00
URANIUM ORE. F.o.b. purchase depot or company mill in accordance with AEC schedules and company buying contracts. Basic price is $1.50 per pound of U_3O_8 in ore assaying 0.10 percent. For each additional 0.01 add 20¢. Subject to development allowance, premiums, penalties where applicable.

NON-METALLIC MINERALS

BARITE: Oil well drilling. Minimum **4.25 specific gravity,** per short ton $16.00
BENTONITE: **Minus-200mesh.** F.o.b. Wyoming. Per ton, carload lots $12.50
Oil Well grade. Packed in 100 pound paper bags $14.00
BORON: technical grade .. F.o.b. Boron California. Per ton $47.50
FLUORSPAR: **Metallurgical grade.** 72.5 % effective CaF_2 content per short ton F.o.b. Illinois-Kentucky mines ... $37.00-$41.00
Mexican. 70% F.o.b. border ..... $26.00-$27.00
Acid Grade. 97% CaF_2, Bulk, F.o.b. mine ..... $48.00-$52.00
PERLITE: **Crude:** F.o.b. mine per short ton ..... $3.00 to $5.00
Plaster grades. Crushed and sized. F.o.b. plants .... $7.00 to $9.00
SULPHUR: Long ton, F.o.b. Hoskins Mound, Texas $25.00
Export ..... $24.00-$25.00

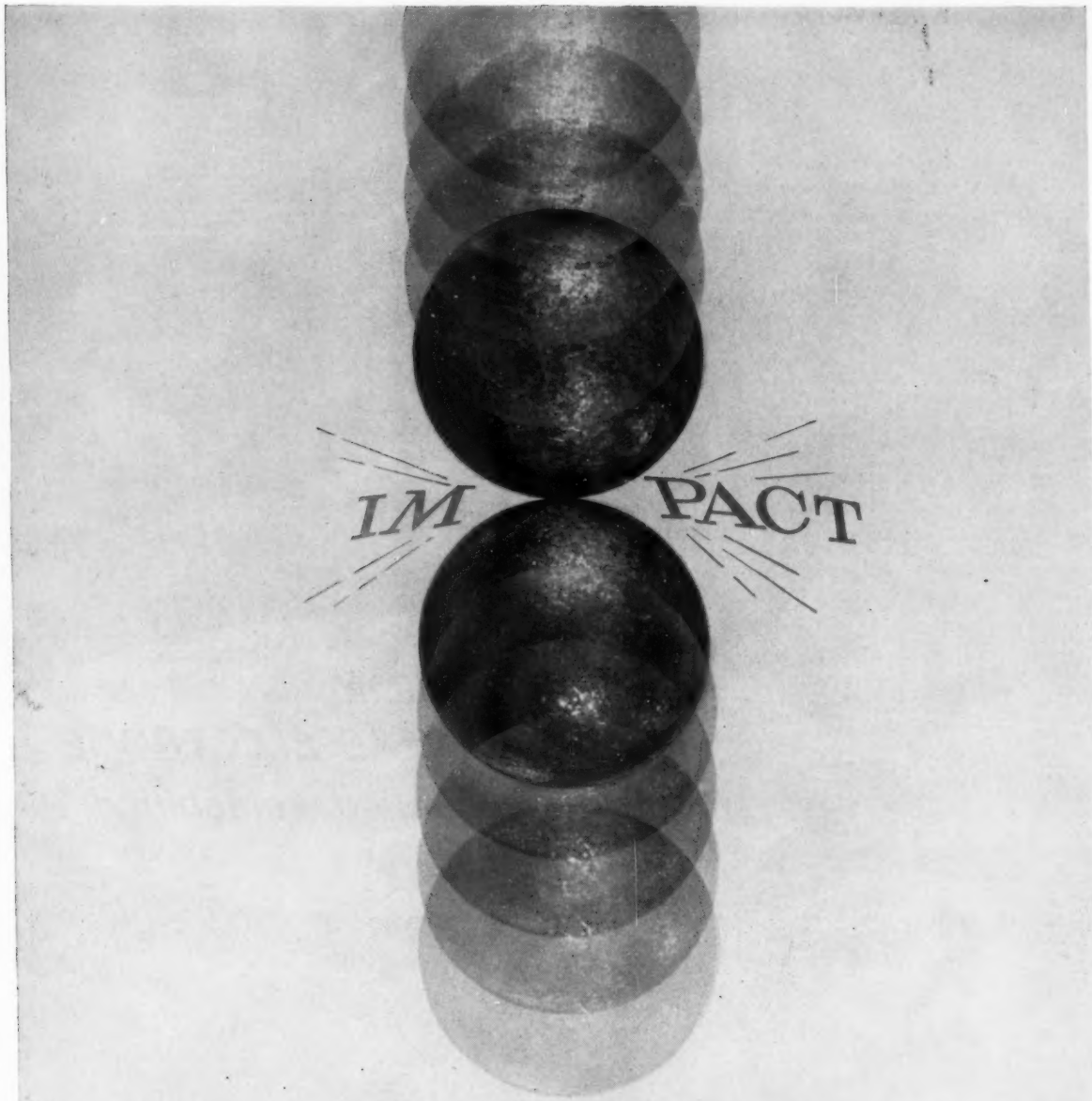
London

August 18, 1959

Per Long Ton USA Equivalent cents per pound*

COPPER:	**Electrolytic spot**	£238	0s 0d	29.75¢
LEAD:	**Refined 99%**	£ 73	10s 0d	9.03¢
ZINC:	**Virgin, 98%**	£ 86	10s 0d	10.81¢
ALUMINUM:	**Ingot, 95.5%**	£180	0s 0d	22.50¢
ANTIMONY:	**Regulus, 99.6%**	£197	10s 0d	24.69¢
TIN:	**Standard, 97.7%**	£793	10s 0d	99.13¢
TUNGSTEN:	**Long ton unit**	97s		$13.58
	*With Sterling			Pound at $.2.80

Quotations on metals and certain ores through the courtesy of *American Metal Market, New York, N. Y.*



MAKES DUST OUT OF MOUNTAINS

Coates Carbex Grinding Balls are made of fine-grained, high-carbon steel. They are especially forged to attain more perfect sphericity, then heat treated to extreme hardness, but with toughness to withstand the IM PACT of milling without shattering.

Coates Grinding Balls have been proven "best buys" in actual production run tests, yet Coates conducts a continuing research program to improve its already highly rated product.

Call for Coates Triple-Forged Grinding Balls . . . built with care for longer wear.

Write for prices . . . All sizes—½" to 5" carried in stock for immediate shipment.

COATES STEEL PRODUCTS CO. CARBEX TRIPLE-FORGED BALLS

COATES

STEEL PRODUCTS COMPANY

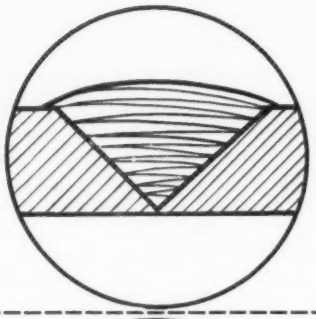
GREENVILLE, ILLINOIS

LARGEST EXCLUSIVE MANUFACTURER OF GRINDING MEDIA

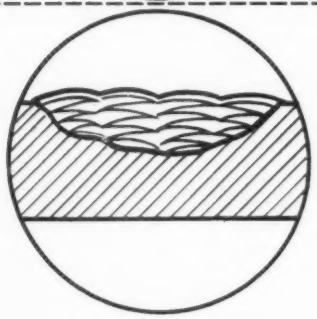
A new
MANGANESE ELECTRODE
with unequalled weldability! *

STOODY NICKEL MANGANESE

WITH IRON POWDER COATING



FOR JOINING



FOR BUILD-UP!

New Stoody Nickel Manganese electrodes solve manganese welding problems in the field or in the shop! You'll find it unexcelled for joining manganese parts or building up worn areas on manganese equipment. Stoody Manganese is now produced as a solid core wire on which the alloying elements in an iron powder coating are extruded. Unusual welding properties are obtained *with physicals unexcelled in the industry!*

Call your Stoody Dealer—check the Yellow Pages of your phone book or write for list of dealers serving your area.

FEATURES:

Stable arc – No popping	Freedom from cracks
Easy re-strike	No porosity
Fast deposition	Easy slag removal
Low spatter	Clean deposits

Cores are uniformly straight and coatings perfectly concentric—insuring a stable, smooth running arc.

Ask your Stoody Dealer for test samples...check speed and welding qualities, *test performance against every other manganese electrode you've ever used...* you'll find Stoody Nickel Manganese provides something *new* and *needed* in the industry!

PHYSICAL PROPERTIES:

(Based on tests by independent laboratory)

	DC Straight Polarity	DC Reverse Polarity
Tensile Strength	119,000 psi	111,000 psi
Yield Strength	67,000 psi	66,000 psi
Elongation in 2"	55%	37.5%

Hardness—Single pass on manganese steel;
as deposited—15 Rc, as work-hardened—48 Rc.
Two passes on manganese steel;
as deposited—18 Rc, as work-hardened—48 Rc.

*Be sure that your Maintenance Superintendent and Welding Foreman see this announcement!

STOODY COMPANY

11932 East Slauson Avenue
Whittier, California

MEN WHO MAKE NEWS IN U.S.

JOHN A. LENTZ

CLARK L. WILSON

ROBERT H. STEBBINS

NEILL K. BANKS

GROVER J. HOLT

ROBERT G. DOYLE

John A. Lentz recently assumed duties as manager of the Morenci Branch, Phelps Dodge Corporation, Morenci, Arizona, succeeding **Lyle M. Barker,** now retired. Mr. Lentz, who received an Engineer of Mines degree from University of Arizona, was first employed in 1935 by Phelps Dodge Corporation at Ajo as a mining engineer and subsequently was promoted to chief engineer at New Cornelia Branch, to mine superintendent and then superintendent at Ajo, before transferral to the Morenci Branch as general superintendent.

Clark L. Wilson, vice president and manager of operations for New Park Mining Company, Salt Lake City, Utah, has been awarded the Professional Degree of geological engineer by the University of Utah in "recognition of experience and outstanding professional attainments in his chosen field."

Recent elections at Carrigan Mines Corporation, of San Leandro, California, with property in Tuolumne County, disclose the following new directors and officers for 1959-1960: **Marvin D. Carrigan,** president; **John A. Buhl,** 1st vice president; **Dr. George E. Martin,** 2nd vice president; **Marjorie R. Johnson,** secretary; **Irene Bickle,** treasurer; **Joseph Long,** field superintendent; **Forrest Eugene Walker,** director.

Annan Cook, San Francisco district geologist for Bear Creek Mining Company, has been promoted and transferred to project geologist by Bear Creek's parent—Kennecott Copper Corporation. Mr. Cook has been assigned to develop the Safford, Arizona copper claims recently purchased by Kennecott, the initial exploration of which was directed by him. Prior to joining Bear Creek, he worked in Africa for Roan Antelope Copper Mines, Ltd. and Frobisher, Ltd.

David C. Lincoln of Cleveland, Ohio has been elected president of Bagdad Copper Company, Bagdad, Arizona, to succeed his father, the late **John C. Lincoln,** who died May 25. Mr. Lincoln, who attended California Institute of Technology before going to Cleveland, is an officer of the Universal Wire Spring Company in Bedford, Ohio.

Thomas N. Walthier has been promoted to manager of Bear Creek Mining Company's San Francisco-Southwest geological district. He will establish headquarters in Tucson, Arizona. Previously he worked for both Bear Creek's Eastern district and company headquarters in Salt Lake City, Utah.

Robert H. Stebbins, formerly geologist and consulting geologist with the Raw Materials Exploration Division, Columbia Iron Mining Co., United States Steel Corporation, has joined the staff of Hunting Technical Services, Inc., New York, as chief geologist for Hunting Geophysical Services, Inc.

Neill K. Banks has been elected president of Texas-Zinc Minerals Corporation, Grand Junction, Colorado. Formerly an engineer at the Austinville, Virginia mine, and superintendent of the Depue, Illinois smelting plant of The New Jersey Zinc Company, Mr. Banks joined Texas-Zinc Minerals in 1957 and was named vice president in February 1959.

Recent changes at the United States Potash Division of United States Borax & Chemical Corporation, Carlsbad, New Mexico, included the promotions of **Robert P. O'Neal** from face boss to relief shift foreman and **Jack Williams** from powderman to face boss. Mr. O'Neal was project manager for Winston Brothers prior to joining the company in October 1958.

Jim Hart, formerly assistant director since February 9, has been promoted to director of public relations for Ray Mines Division, Kennecott Copper Corporation, at Hayden, Arizona. Mr. Hart succeeds **Peyton H. Canary III,** who plans to enter the public relations business in Phoenix.

Frederick L. Brucker, Phoenix, has been elected president of Hirsch Bros. Machinery Co., El Paso, Texas, manufacturers of mining equipment. Mr. Brucker has been serving as Southwest district manager of Hewitt-Robins, Inc.

Dr. Reuben G. Gustavson, president and executive director of Resources for the Future, Inc., Washington, D.C. since 1953, has been appointed professor of Chemistry at the University of Arizona, Tucson. Dr. Gustavson has served as chancellor of the University of Nebraska, dean of faculties and vice president of the University of Chicago, and Dean of the graduate school, University of Colorado.

Harlan Holden, geological engineer from the Reno, Nevada, field office of the United States Atomic Energy Commission, is scheduled to replace **W. T. Maguire** as mining engineer with the AEC's Northwest district office in Spokane. Mr. Maguire is resigning to join the J. R. Simplot organization at Pocatello, Idaho; Mr. Holden was formerly with the Hecla Mining Company at the Star mine near Wallace, Idaho.

Grover J. Holt has officially retired as assistant to the president of The Cleveland-Cliffs Iron Company at Ishpeming, Michigan, and will be taking up new residence at 403 Magdalena Avenue, San Clemente, California. Mr. Holt, 1956 president of American Institute of Mining and Metallurgical Engineers, will be on a consultation basis for Ceveland-Cliffs and will be doing other consulting work in connection with mining and metallurgical treatment of iron ores.

Robert G. Doyle has been appointed State Geologist with The Maine Geological Survey, to replace **John R. Rand,** recently retired. Formerly staff geologist with St. Joseph Lead Company in Southeast Missouri, Mr. Doyle became assistant to the state geologist in July 1958.

Sven E. Johansson, former Analyst for Ford Motor Company, Brook Park, Ohio, entered the employ of the Kennecott Copper Corporation in April of this year as Industrial Engineer at the Ray, Arizona, operations.

George L. Spencer, Jr. of St. Louis, Missouri has been elected vice president of the American Zinc, Lead & Smelting Company. Mr. Spencer, who received his B. S. and M. S. in Chemical Engineering from Washington University in 1927, has been employed by the American Zinc Company, a wholly owned subsidiary, since his graduation, serving as vice president since November 1955.

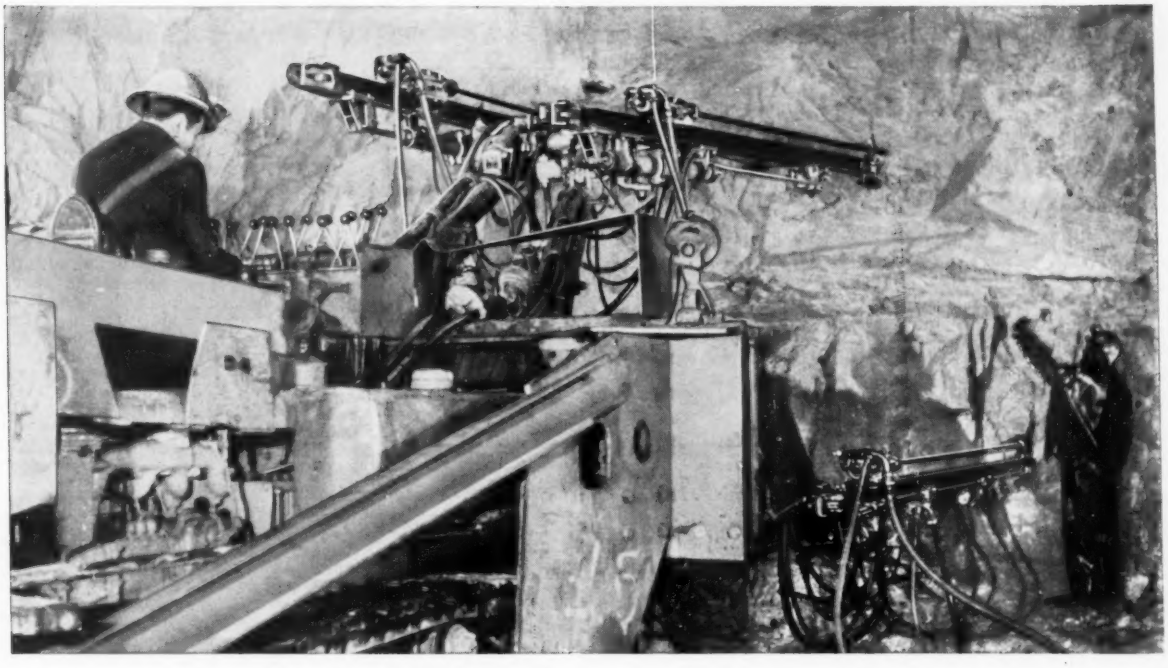
George Havas, general manager of the Heavy Construction Division and vice president of Henry J. Kaiser Company, has received the honorary degree of Doctor of Engineering from Rensselaer Polytechnic Institute of Troy, New York, in recognition of his "outstanding record as one of the world's foremost builders", having built steel, aluminum & chemical plants throughout the world.

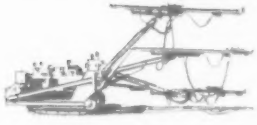
Dr. Joseph L. Gillson, chief geologist, E. I. du Pont de Nemours & Co., and president-elect of the American Institute of Mining, Metallurgical & Petroleum Engineers, will represent the Institute at the International Geological Congress in Copenhagen in 1960.

The Metallurgical Society of AIME has announced that **Charles R. Kuzell,** director of the Phelps Dodge Corporaion, will deliver the 1960 Extractive Metallurgy Lecture at the annual meeting of the Institute to be held in New York. Mr. Kuzell, who received the 1956 James Douglas Gold Medal for "outstanding contributions to nonferrous metallurgy"

HYDRA-BOOMS

speed underground drilling in Canada's URANIUM MINING BOOM





Unlike the gold rush of Klondike days, the uranium boom in Canada's Algoma Elliott Lake area is spearheaded by the most efficient *mechanized* equipment. To speed up drilling with minimum effort, the Panel Mine of Northspan Uranium Mines Ltd. is using four Ingersoll-Rand Hydra-Boom drilling rigs, one of which is shown above, operating 1700 feet below the surface.

Each tractor-mounted rig carries three heavy-duty I-R drifter drills mounted on Ingersoll-Rand Hydra-Booms, providing smooth effortless hydraulic control of all drill motions. Booms are raised or lowered and swung from side to side and drill guides are extended, retracted, dumped and swung at the touch of a throttle—all drills easily controlled by one rig operator. Using 1⅛″ round steel and 1¾″ tungsten carbide insert bits, these rigs are used in a room and pillar trackless mining operation, teamed with 48″ ramps mounting 30-hp I-R slusher hoists.

I-R Hydra-Booms represent the last word in *mechanized* rock drilling—convert setup time into drilling time and increase production by as much as two-to-one. Rugged, versatile and easy to operate, Hydra-Booms are designed and built to withstand the punishment and abuse inherent in underground mining operations. Swing and lift cylinders are double acting, fast moving, and locked to prevent dropping the boom if hydraulic lines are broken.

Ask your Ingersoll-Rand drilling engineer for complete, cost-saving facts about I-R Hydra-Booms. Or send for a copy of new bulletin 4196.

Ingersoll-Rand

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will speak on the development of modern copper smelting.

Martin Hannifan has been appointed manager of mines for the Anaconda Company, Butte, Montana. Mr. Hannifan was formerly assistant general superintendent in charge of the Kelley mine and has had a background of much mining experience in the United States and South America.

A. P. Kibbe, president of Hidden Splendor Mining Company, Salt Lake City, Utah, was recently elected to the board of directors of the Uranium Reduction Company. Mr. Kibbe succeeds **Ray O. Ryan**, representative of the Atlas Corporation on the U.R.C. board. Hidden Splendor is a wholly owned Atlas subsidiary which is in the process of being converted into a publicly owned firm.

Kenneth L. Power, concentrator superintendent for Inspiration Consolidated Copper Company, Inspiration, Arizona, was awarded the professional degree of Metallurgical Engineer by the University of Arizona. Mr. Power, who has been with Inspiration since 1955, was active in the design and construction phases of the company's new flotation mill.

Douglas Cook, senior geologist of Bear Creek Mining Company, Salt Lake City, Utah, has been elected president of the Utah Geological Society. Bear Creek is a wholly-owned domestic exploration subsidiary of Kennecott Copper Corporation.

Hugh M. Roberts, consulting geologist of Duluth, Minnesota, was recently honored by the Lake Superior Geology Club as "Lake Superior Geologist." The plaque, which was presented to Mr. Roberts, read in part, "It is given in recognition of his sage council and continued encouragement to the Club, its membership, and for his worthly contributions to the study of iron ores in the Lake Superior Region."

Fred Dyson, former superintendent of Cooley District of M. A. Hanna Company, has been appointed general superintendent of the M. A. Hanna mines, Mesabi Range. He succeeds **R. B. Crist** who was transferred to Cleveland as general operating engineer. **LeRoy Clover** replaces Mr. Dyson and **D. K. Nelson** replaces Mr. Clover as assistant superintendent of the Cooley District.

Adolph C. Seaberg has been named superintendent of the Lind-Greenway Mine of Jones and Laughlin Steel Corporation, Minnesota Ore Division. He was formerly general mine foreman at Jones & Laughlin's Hill Annex Mine. **J. R. Gross**, former pit turn foreman at Hill Annex, Calumet, Minnesota, succeeded Mr. Seaberg at the Hill Annex Mine.

National Potash Company recently announced several promotions at its New Mexico refinery and mine. **R. J. Farranti**, refinery shift foreman, has been advanced to the position of refinery superintendent. Other advancements include **Lloyd W. Weems** to refinery shift foreman; **Marlyn L. Davis** to design engineer; **Clifford H. Ackman** to shift foreman in the refinery; and **Archie A. Pitts** and **Carl J. Giaudrone** to assistant foremen, or face bosses, at the mine.

Dr. Thomas M. Morris has been named professor and head of the department of mining and metallurgical engineering at the University of Arizona's College of Mines, Tucson, Arizona. Dr. Morris, former professor of metallurgical engineering at the Missouri School of Mines, succeeded **Dr. John B. Cunningham**, who retired recently.

Max M. Blackham of Ely, Nevada has been named supervisor of industrial relations for the electrolytic refinery of the Utah Copper Division, Kennecott Copper Corporation. Mr. Blackham joined Kennecott at its Nevada Mines Division at McGill in 1946. He was named mines plant supervisor of industrial relations at the Nevada Division in 1957.

Raymond V. Kettner, assistant research engineer of the Anaconda Research Department, Butte, recently returned from a two-month trip to Chile, South America.

F. C. Green, general manager of Kennecott Copper Corporation's Utah Copper Division, recently announced several appointments. **Grey Bogden**, supervisor of industrial relations, department of mills, Utah Copper Division, was promoted to union relations administrator. **Larry D. Cripe**, placement, wage and salary manager with Calumet Division of Calumet & Hecla, Inc., has been appointed wage and salary administrator. **C. L. Teagarden**, personnel and safety advisor, Utah Development Company, has been promoted to industrial relations representative at Utah Copper Division.

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WILLIAMS HoleMaker and K-Type air and water rock bits utilize air or water to cool, lubricate and clean bearings for faster, more economical rotary drilling. A complete range of sizes from $2^{15}/_{16}$" to $7^{7}/_{8}$" comprises various tooth designs to drill more footage at a faster rate of penetration. For soft formations — widely spaced, long sharp teeth. For hard formations — closely spaced, short rugged teeth.

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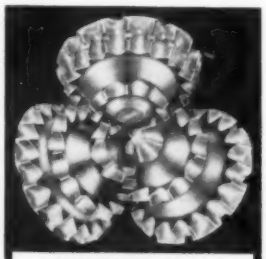

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Cost figures tell the story in toughest conditions

Frozen Rocky Clay

DRILLING AND BLASTING

Block: 4,635 square foot area
153 four-foot-deep holes, four-and-one-half-inch diameter.

Labor required:

3.1 Shifts, Driller	@	$19.20	$ 59.52
3.1 Shifts, Driller Helper	@	18.16	56.30
0.6 Shift, Blaster	@	20.24	12.14
0.6 Shift, Blaster Helper	@	17.12	10.27
			$138.23

Explosives Required: 195.00

Machine Expense:

3.1 x 8 = 24.8 hours of pneumatic drill	@	3.35	83.08

Estimated Cost: Drilling and Blasting $416.31

RIPPING

Same area, same material

Method: D9 Tractor and Kelley Ripper—8 hours
4 initial passes, one cross-ripping pass
Doze off first layer and repeat process once
8 x $21.63 $173.04

Estimated Daily Savings—Ripping instead of blasting $243.27

Days for D9 and Ripper to pay for itself 225 days

SUMMARY: The D9 and Kelley Ripper breaks frozen areas faster and more economically than any other method.

Those are the figures. The D9 and Kelley Ripper broke this frozen material into bite-size pieces for power shovels at a cost of only 20¢/yard, a *total* cost of only $173. This is less than the cost of explosives *alone*. And it was 58% less than the total cost of drilling and blasting.

And this was in some of the toughest material a ripper can encounter. The sandy clay was heavily embedded with boulders up to one yard in diameter. One test block was frozen five feet deep.

If you wrestle with frozen overburden, your Caterpillar Dealer has more facts on this new tractor-ripper method. Get in touch with him today.

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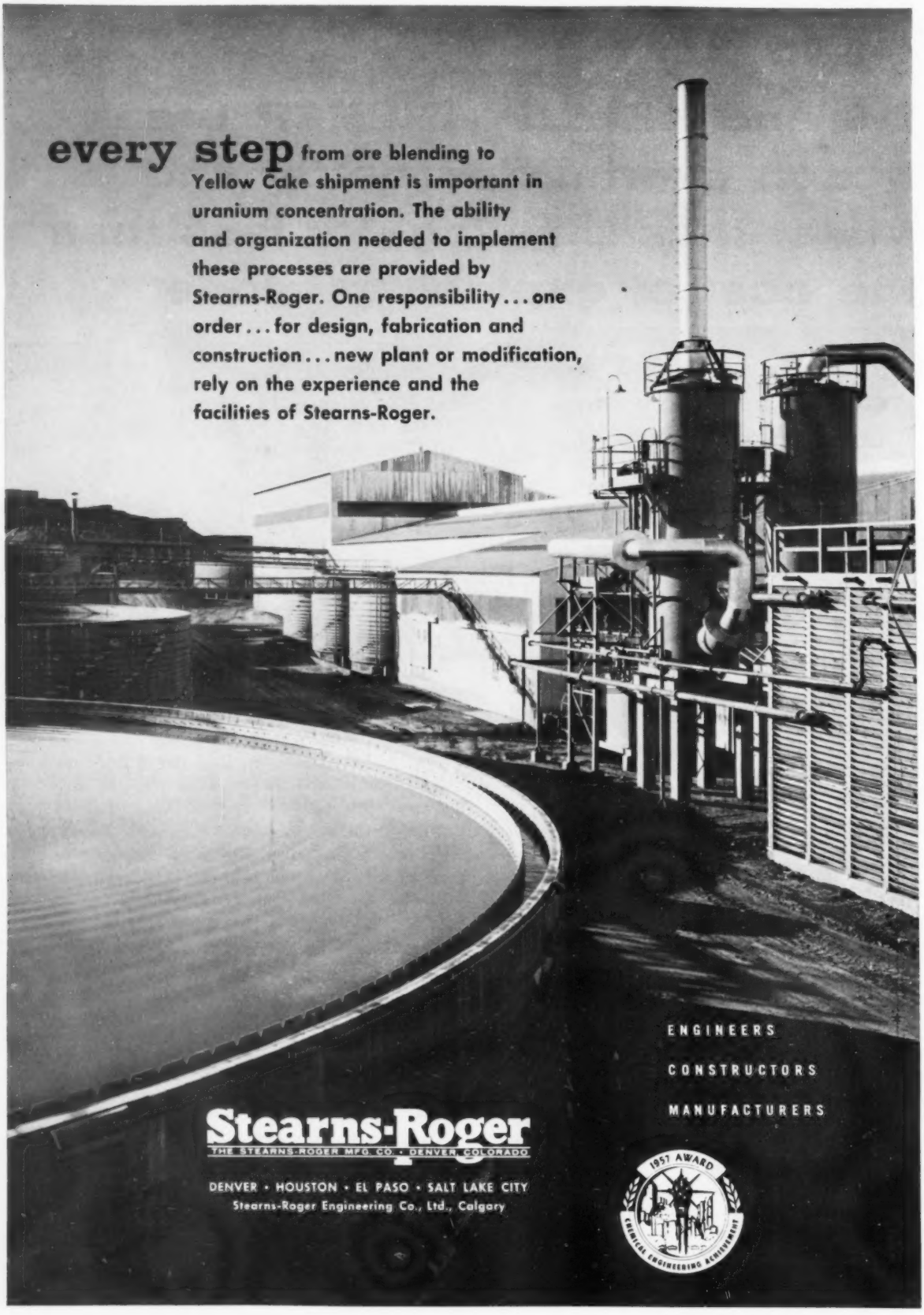
every step from ore blending to Yellow Cake shipment is important in uranium concentration. The ability and organization needed to implement these processes are provided by Stearns-Roger. One responsibility... one order... for design, fabrication and construction... new plant or modification, rely on the experience and the facilities of Stearns-Roger.
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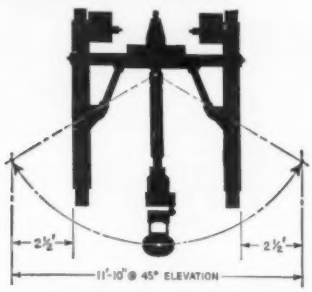
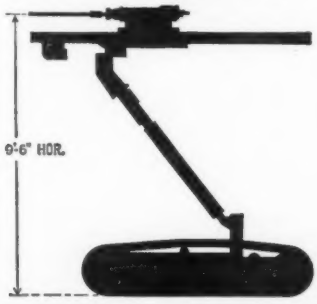
MORE SWING



...MORE REACH



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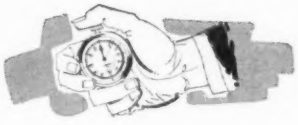
with Gardner-Denver Swing-Boom "Air-Trac"®



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Swings 11'10" . . . 2½' over both tracks Now drill more hole from one position . . . drill over a ledge from either side. Feed swings 11'10" at 45° elevation . . . moves to 2½' outside of each track with balanced stability.

Reaches to 9'6" height—for horizontal drilling Get better spacing of horizontal holes . . . reach to 9'6" for high breast holes.

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Pulls tight steel Powerful Gardner-Denver 5-cylinder radial air motor enables your driller to put the right pressure on the bit in all drilling situations . . . provides necessary pulling power to bring tight steel out of the hole.

Maintains hole alignment Easily handles in-line drilling . . . drilling in fitchery or fractured formations. Creep-free hydraulic boom keeps drill in position . . . track locks keep rig firmly in place in difficult drilling spots.

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WHAT'S GOING ON IN MINING

Kennecott To Modernize Garfield Copper Smelter

Western-Knapp Engineering Company of San Francisco, California has been awarded a contract to engineer part of a proposed $10,000,000 improvement and modernization program at the Kennecott Copper Corporation's Utah Copper Division smelter. The smelter, at Garfield, Utah, was acquired the first of the year from American Smelting and Refining Company as part of a company-wide integration program.

Western-Knapp will study ways of converting the present preroasting process to a direct smelting process; modernization of the material handling system; enlargement and modernization of the three reverberatory furnaces; and installation of new waste heat boilers. Other modification will probably be scheduled later.

The contract award was based on consideration of a car dumper to replace the present clam shell system used to empty the concentrate from railroad cars, with possible elimination of intermediate handling of the roasting material. Under this system, concentrate would be taken directly to the point of use with fluxing material being added along the way.

In addition to being enlarged, the present spring arch silica brick roofs of the three reverberatory furnaces would be replaced with suspended brick roofs. Installation of the new waste heat boilers would allow use of excess waste heat in pre-heating the combustion air for the reverberatory furnaces.

COLORADO

Climax Molybdenum Company at Climax, Colorado has placed its mining and milling operations on a seven-day production week to improve overall operating efficiency, particularly in the milling process. Departments directly concerned with a production of molybdenum ore and its concentration will be most affected. Other departments, such as supply, transportation, etc., may alter their schedules somewhat to accommodate the longer production week.

The **Columbus** lead-zinc mine at Animas Forks near Silverton, Colorado, is being reopened by Jack Dick of Delta. He also plans to reactivate the **Yellow Rose** mine in the same vicinity. There is a considerable amount of broken ore to be removed before stoping operations get under way. Smelter grade ore is being sorted out and shipped to the Midvale, Utah smelter. Mill-grade ore will be stockpiled until milling facilities are available in the immediate area.

The **Silent Friend** claim in the Animas Forks area of Colorado is being developed by Tex Cross and associates. An access road to the property is being constructed. Samples show values in lead, silver, zinc, and copper. The ore will be sorted and shipped crude to a smelter until a local mill is available. Low-grade ore will be stockpiled.

The **Argyle Mining and Milling Corporation** reportedly plans to merge with **Tri-State Oil Company.** The new firm will continue to operate the **Pride** and **Osceola mines** in the Silverton, Colorado area.

English Oil Company holds slightly less than 50 percent of newly organized **Marvel Mining Company.** Marvel's **Carpenter Flat** unanium mine in the Uravan district of Colorado is presently being mined by a lessee.

Lucius Pitkin Inc. has taken over as agent for the **U.S. Atomic Energy Commission** in the Grand Junction, Colorado area. The firm replaces Swinerton & Walberg Company.

Under an industrial contract with the **Superior Graphite Company** of Chicago, the **Colorado School of Mines Research Foundation** is piloting the production of low-ash amorphous graphite from Mexican deposits. It is anticipated that this product will find applications in areas where amorphous graphite is not presently acceptable because of ash content. Suggested areas include steel, pigments, nucleonics, lubricants, parts fabrication, and high temperature applications. Small samples of pilot product may be obtained for study by interested parties by contacting the Foundation at Golden, Colorado.

UTAH

Three uranium claims in the Big Indian district of San Juan County, Utah will be developed by **Union Carbide Nuclear Company,** a subsidiary of **Union Carbide Corporation.** The claims are located between properties of **Utex Exploration Company** and **Lisbon Uranium Corporation.** They are owned by **Homestead Corporation.**

The **Texas-Zinc Minerals Corporation's** uranium mill at Mexican Hat, Utah expected to continued operations during the summer despite a threatened water shortage from the shrinking San Juan River. Although the river was low, there was sufficient water for mill operations early in August, and it is expected that the driest part of the summer was over. Fall rains are expected to return water conditions to normal.

Directors of **Lisbon Uranium Corporation** in Salt Lake City, Utah have declared the firm's first dividend since it was organized in 1954. Since start of production about two years ago, the company has mined and shipped about 200,000 tons of ore with an average grade of 0.60 percent U_3O_8 from its property in the Big Indian district of San Juan

New Uranium Mill Claims Successful Upgrading

The uranium upgrading plant shown above has gone into operation in the East Gas Hills of Wyoming. A joint venture of International Mining Company of Greenville, Ohio and American Mills Inc. of Dallas, Texas, the $100,000 plant uses a new ultrasonic process invented by Arthur Dearing, president of International. Company officials claim that the plant can upgrade 0.08 percent uranium oxide ore to 30.0 percent and more, and can work on ore as low grade as 0.04 percent. Uranium companies are invited to submit submarginal ores for tests. Samples for from five to 10 tons will be run at no charge. Arrangements may be made by writing to International's main office at 721 Riffle Avenue in Greenville. According to Bill Simpson, president of American Mills, the plant presently can handle 100 tons per day, but can be expanded to 500 to 600 tons with a minimum of expense.

County. Lisbon is one of four companies scheduled to be merged into **The Hidden Splendor Mining Company,** a wholly owned subsidiary of **Atlas Corporation.**

Kennecott Copper Corporation will be housed in a new $6,500,000 building in Salt Lake City, Utah sometime after scheduled completion date in 1961. The building is to be named the Kennecott Building, but is not being financed, constructed, or managed by the firm. Officials of **Zions Securities Corporation** who are undertaking the project have decided to name it after Kennecott as a tribute to the company's role in development of the state, and also because it will be a principal tenant.

Utah Copper Division of **Kennecott Copper Corporation** has installed an extensive $157,000 two-way radio communications system to improve operational efficiency at the mine in Bingham Canyon and related ore haulage operations. Some 100 individual sets are now in ore and waste locomotives and other mobile equipment at the mine. An additional 25 are installed on the 11 locomotives and supervisory and maintenance vehicles of the ore haulage department. Another group have been installed at Copperton Yards, Cyprus, and the Utah Magna mill and Utah smelter.

WYOMING

Globe Mining Company's new uranium mill, being built 75 miles west of Casper, Wyoming in the East Gas Hills, is expected to go into production in January 1960. **J. H. Pomeroy and Company** of San Francisco has the construction contract. Included will be an ore crushing unit, fine ore storage building, main mill building, and adjoining maintenance shop. Strip mining will take place near the mill site and also at Globe's properties 12 miles away. K. W. Lentz will be mill superintendent. Globe is a subsidiary of **Union Carbide Nuclear Company.**

Construction of **Federal-Radorock—Gas Hills Partners'** new uranium mill in the West Gas Hills is making steady progress and may be in operation by the end of this year. Mining is keeping pace with mill construction so that considerable ore will be stockpiled when the mill goes on stream. The **Sagebrush D-1** pit is 35 feet deep, and mining is being conducted with a Unit ¾ shovel. Stripping will start soon on the **Bus** claims where a 160-foot-deep pit is planned.

Susquehanna-Western Inc.'s contract to buy 480,000 pounds of uranium oxide from **Vitro Minerals Corporation** (see MINING WORLD, July 1959, page 7) will mean a mining rate for Vitro of more than 100,000 tons of ore per year at the estimated grade of the Wyoming deposits. The ore will come from a large number of mining properties, including the **John Group, George Group, Grunnell Group, Ver Group, Out West Group, Myrna Lynn** mine, **Shoni** claims, **Cheyenne Group, Gibson Group,** and others. Shipments are to run until the end of 1966 and may exceed $15,000,000 in value. The Susquehanna Corporation, with its subsidiaries, is expected to turn out over 1,350,000 pounds of uranium concentrate annually for sale to the AEC.

Western Nuclear Corporation resumed operations at its Jeffrey City, Wyoming plant early in August after a shutdown for modifications. The plant was closed June 12 for installation of new ore handling facilities, crushing and drying facilities, and an increase in leach capacity. Mining activity continued during this period, with some ore mined from the shallower parts of the **Frazer-Lamac pit.** The main ore body will be encountered at a depth of 275 to 300 feet, sometime around September 1, at which time a major mining program will start. The first phase of stripping will have moved over 6,000,000 cubic yards of dirt. The overall project expects to move 18,000,000 yards. Stripping on the **P-C Mining Corporation** pit in the East Gas Hills has been completed and Western Nuclear will mine it. Ore is allocated to the **Susquehanna-Western** mill at Riverton. The P-C pit is about 120 feet deep and is an extension of the mine opened up by P-C 18 months ago.

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ARIZONA

Development work has been started by **Kennecott Copper Corporation** on its recently acquired copper prospect comprised of 125 claims in the Gila Mountains north of Safford, Arizona. The firm took over the claims from its exploration subsidiary, **Bear Creek Mining Company,** and started actual development work. A small team of geologists and engineers has been assigned to the project. Work in the immediate future will consist chiefly of drilling and mapping the ore body. About a dozen men will be working at least through the rest of this year. Kennecott, through Bear Creek, recently bought the claims for $3,800,000 from 13 persons, most of them from Safford.

Inspiration Consolidated Copper Company is expected to start work in September on an operating shaft for the **Christmas** copper mine, near Winkelman, Arizona. This shaft sinking is one part of the current development program which calls for preparing the Christmas mine for production in about three years. The planned production rate for the mine is 4,000 tons of ore daily, or about 36,000,000 pounds of copper annually. Inspiration recently made application for mineral patent on a group of 46 lode claims, the Christmas Numbers 1 and 2, and Inspiration Lodes, Numbers 1 to 44, inclusive, all under Mineral Survey No. 4443.

The property recently optioned by **American Metal Climax Inc.** in the Gila Mountains near Safford, Arizona was acquired from Guy Anderson, Clyde Peters, H. J. Peters, Mrs. Fernie Tibbets, and Paul Ramirez. The 254 copper prospect claims adjoin on the east the 125 claims recently acquired by **Kennecott Copper Corporation** for $3,800,000. The agreement gives American Metal 4½ years for exploration. After the first 15 months, the firm is to pay the owners $1,500 per month rent. If the options are exercised, American Metal will pay $3,000,000.

Ran Rex Oil and Mining Company has resumed work at the **Copper Giant** mine in Mohave County, Arizona, and a small crew is employed. Lynn Burr of Hackberry, Arizona is directing the work. The men at present are breaking down the back of the adit near the old shaft, preparatory to installing chutes and starting to stope the ore. Car samples taken during the driving of the adit were reported to have demonstrated an ore shoot some 250 to 300 feet long with ore continuing in the south end of the workings. The company is said to believe that sufficient reserves of copper-gold ore have been opened to justify a 100-ton mill. Henry Fillers of Bountiful, Utah is president of Ran Rex.

Bear Creek Mining Company, a subsidiary of **Kennecott Copper Corporation,** has been staking and working a group of claims in the Castle Hot Springs area east of Wickenburg, Arizona.

San Manuel Copper Corporation at San Manuel, Arizona reports that the first six months of this year it produced 76,434,274 pounds of copper. In the same period of 1958, the firm produced 73,038,831 pounds, making this latest output the highest copper output from the mine so far. **Magma Copper Company,** the parent firm, produced 22,226,153 pounds of copper in the first six months of 1959, compared with 22,644,764 pounds in the first half of 1958. Total output from both mines was 98,660,427 pounds for the first six months of 1959.

The major development program being undertaken by **Western Gold & Uranium Inc.** to increase production from its **Orphan** mine near Grand Canyon, Arizona is proceeding on schedule. Completion is expected about October 1.

Shipments of copper ore, at the rate of one carload daily, are going to the smelter from the **King in Exile** mines in the Helvetia District of Pima County. The property is owned by **Lewisohn Copper Corporation** and operated under lease by Richard E. Chilson of Tucson, Arizona. He employs 12 to 15 men, working two shifts, and all production is from underground stoping operations.

The **B. S. & K. Mining Company** is continuing regular production at the

NOW.. the 'Canton' Air-Power Car Transfer

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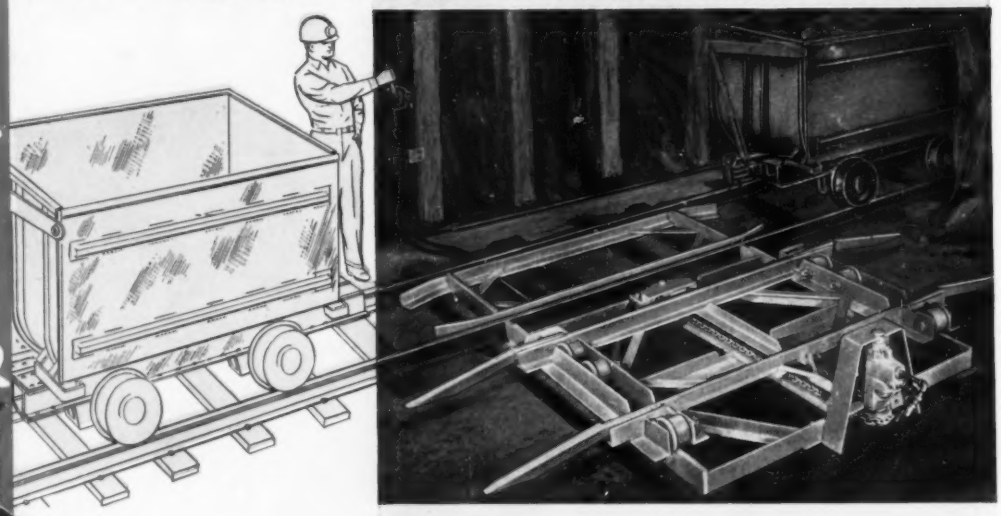

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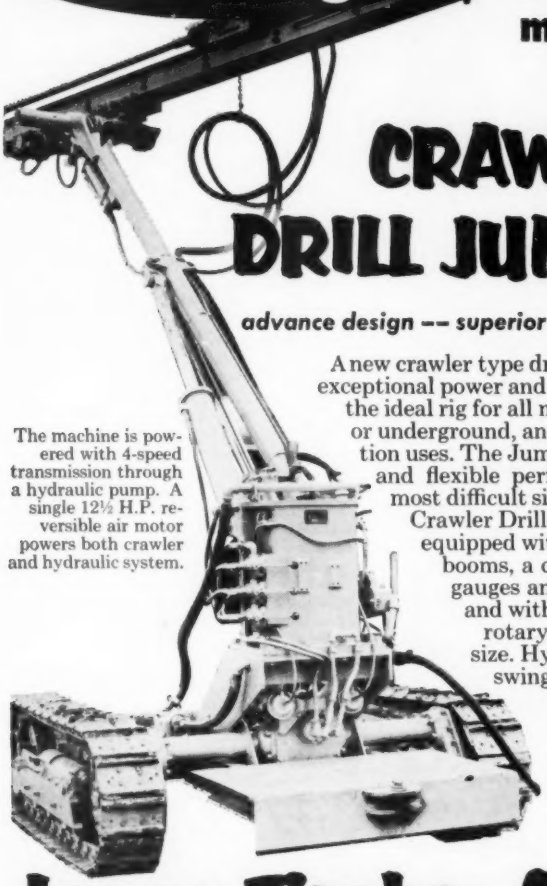

The machine is powered with 4-speed transmission through a hydraulic pump. A single 12½ H.P. reversible air motor powers both crawler and hydraulic system.

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. . . does double duty . . . cuts timbering time to minimum

The Lance Timber Cage is designed to transport shaft timbers, and serve as staging in setting-up operations. When a full set of timber is lowered to the proper position in the shaft, the doors are opened (horizontal position) to serve as a staging for the workmen who position the shaft sets. The wall plates are hung in brackets on the sides of the cage for transporting, and when positioned at proper level, the plates are pivoted from vertical to horizontal position (see arrow) where they are safely and efficiently set in minimum time.

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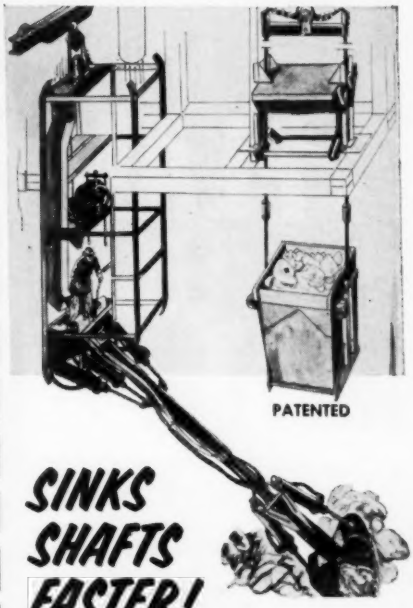

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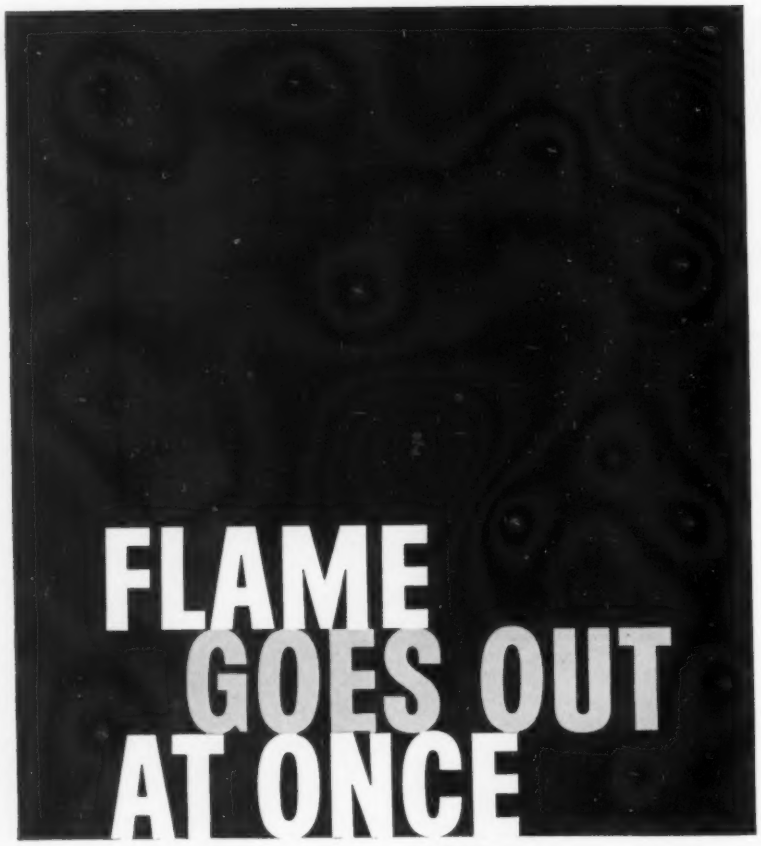

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Thermocoal Conveyor Belting

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The material? Thermoid-Quaker *Thermocoal* Conveyor Belting with fire-resistant, flame-retardant neoprene cover and cotton-nylon reinforcement.

The requirements? No more than one minute of burning after the belt is ignited.

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SOUTHWEST

Atlas mine and mill, near Red Rock, Arizona, mining about 1,100 tons of zinc-copper ore monthly. Zinc concentrates are shipped to **American Smelting and Refining Company** at Amarillo, and the copper concentrates to ASARCO at El Paso, Texas. The operating crew numbers 17, with 12 men working in the mine and 5 in the mill. A. M. Kalaf of Phoenix, Arizona, is president of the company.

Ore shipments, at a rate of about 15 carloads per week, are being made from the **Narragansett** mine in the Helvetia district of Pima County, Arizona, to the Asarco smelter at Hayden. The ore, an oxidized copper with high lime values, is mined by open-pit methods, then trucked to Sahuarita for rail shipment to Hayden. Operator of the property is C. Darrel Wilson of Tucson, manager, and Hercel Hickman of Tucson, mine foreman.

Nash and McFarland are continuing the production of lead and zinc ore from the **Flux** mine in the Harshaw district of Arizona and milling same at the Trench mill. Production is at the rate of 2,600 tons monthly, with a crew of 38 men working six days per week. Electric power for milling operations is now supplied by **Citizens Utility Company,** connection having been made the middle of March. E. W. McFarland of Nogales, Arizona, is directing the work.

The **Arizona Bureau of Mines, University of Arizona,** at Tucson, has announced completion of the Geologic Map of Yavapai County. On a scale of 1-to-375,000, or six miles to the inch, the map charts rock types and partial topography. Copies may be obtained from the bureau for 75¢ each. This map is the third in a series, the previous two covering Maricopa County and Graham-Greenlee Counties. The map for Mohave County is expected to be completed soon.

CALIFORNIA

Kern County Land Company has contracted with an unidentified firm to develop borate deposits on 1,500 acres of Kern's property in California's Mojave Desert. Kern has drilled 17 exploratory holes in the areas over the past four years.

American Smelting & Refining Company has threatened to close its Selby, California smelter and move its operations out of the San Francisco Bay Area if controversial anti-industrial smog ordinances are approved in their present form. The firm says it would be uneconomic to operate the plant under the rules of the pollution regulation as they are proposed. The Selby smelter produces lead and zinc, along with byproduct refinement of gold, silver, tin, platinum, and bismuth.

Gold Canyon Mines Inc. of Stockton, California reports it has built a mine access road to its property in the Alleghany mining district of Sierra County, California. The firm has also installed a power

NORTHWEST

line and purchased necessary equipment and machinery. All of these items are now installed and housed, and water has been brought in from nearby springs. The crew has been cleaning out a few winzes, adit, and shaft preparatory to actual development and mining of the old **Gold Canyon** mine.

Crystal Ball Mining Company is currently furnacing 70 tons of mercury per day at its property in the Almaden mining district of Santa Clara County, California. Woodrow Goodman is general manager.

NEVADA

Manganese Inc., operating at Henderson, Nevada, is now mining manganese ore from the **Hulin Pit** discovered earlier this year. The discovery was made as workers were finishing operations in the large pit which had been mined since 1942. The new pit is located at a point where three faults join; its location was found during a five-month drilling program. Drilling is continuing in other parts of the property in an attempt to find other ore. The Hulin pit is expected to yield about 60,000 tons.

Nevada Minerals & Oil Corporation has arranged to ship a minimum of 3,000 tons or a maximum of 7,500 tons of ore to the **U.S. Milling & Minerals Corporation's** mill at Silver Peak, Nevada. First shipment should be made shortly. The ore will be mined from the **Tonopah Belmont, North Star,** and **Tonopah Montana** mines. It will be milled on a custom basis.

Standard Slag Company will ship 308,500 long tons of iron ore to Japan over the next year from its Nevada property. All of this will come from the **Minnesota** mine in the Buckskin district of Douglas County, Nevada. John R. Harmon is superintendent of the Minnesota mine.

The old Baxter mill at Gabbs, Nevada, originally built to recover tungsten, has been acquired by **Kenard Mining & Milling** and is now treating lead-silver ores from the **San Rafael** mine at Quartz Mountain. Gerald S. Kennedy and Dr. Paul C. Goddard are partners in the firm, with Mr. Kennedy serving as general manager.

The **Chemical and Pigment Company** of Oakland, California is reported to be undertaking development of the **Jumbo** barite property in the Ellendale district of Nevada. According to reports, **Wells Cargo Inc.** has completed preliminary drilling and will mine and ship 5,000 to 8,000 tons of barite ore from the property. A crusher and screening plant will be installed to make aggregate for high density concrete which will be used by the AEC at its Nevada Test Site. The crude ore will be shipped to Chemical and Pigment's Oakland plant for use as a paint additive.

Argentum Mining Company of Mina, Nevada is expanding its operations. The firm has a gravity flotation mill at Columbus Marsh, and treats ore from the **Northern Belle, Mt. Diablo,** and **Holmes** silver mines near Candelaria.

Reed and Sons of Fallon, Nevada, leasing the **Bootstrap** mine in Elko County, Nevada, report that they have struck a vein of gold ore. The property is owned by R. L. Taylor, M. S. Fisher, and Claude Taylor of Battle Mountain and Harry Treweek of Gold Acres.

NEW MEXICO

Big Divide Mining Corporation is now spending full time in drifting on a vein to the southeast of the Big Divide tunnel on Gold Mountain, six miles south of Tonopah, Nevada. The vein was discovered during installation of a side track.

Lance Corporation of Gallup, New Mexico bottomed its shaft in the **Black Jack** uranium mine located on the western-most Ambrosia Lake trend. The firm is a subsidiary of **Sabre-Pinon Corporation**; **Homestake Mining Company** recently paid $1,350,000 for a 25 percent interest in Lance.

Kaiser Gypsum Company reportedly will construct a new gypsum plant near Albuquerque, New Mexico. The plant will be erected adjacent to a high-grade gypsum deposit at Rosario. Production is expected to begin in June 1960. Rated capacity will be 120,000,000 square feet of gypsum board annually.

Both production and grade of uranium ore mined by **Calumet & Helca Inc.** at its Ambrosia Lake property in New Mexico have been higher than anticipated during the first half of this year. Recognizing that the uranium operation will be "comparatively short lived," the company has been actively seeking ways of compensating for the anticipated decline in earnings from that source in a few years.

At its annual meeting in Albuquerque, New Mexico, **Ranchers Exploration and Development Corporation** announced that three mining shafts have been completed and a fourth is about to be started on or in the vicinity of Ranchers' properties which have not been previously developed. The firm's two largest ore bodies have been brought into production and additional exploration activities have resulted in increasing substantially the reserves of the company. The Board made a basic decision to make Ranchers an operating company. It is composed primarily of ranchers with land and subsurface holdings in the Ambrosia Lake district. It has long-term agreements with **Phillips Petroleum Company** and **Kermac Nuclear Fuels Corporation.**

In a further court ruling on the dispute between **Homestake Mining Company** and its partners in **Homestake-New Mexico Partners** (see MINING WORLD, June

Asarco Leases 2,560 Acres of Papago Indian Reservation for New Copper Mine Waste Dumps

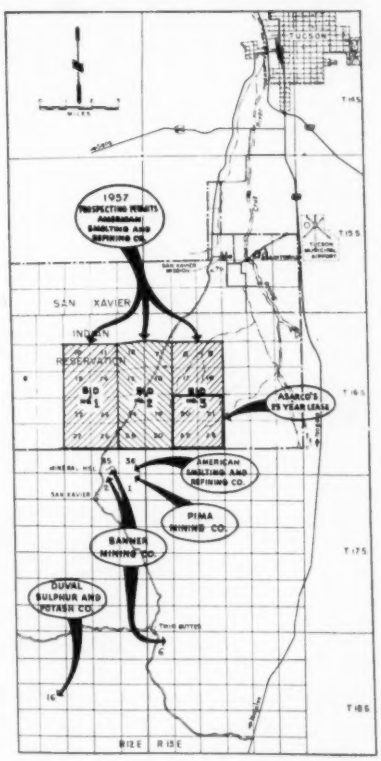
American Smelting and Refining Company has concluded negotiations under which it will pay $384,000 for a 25-year lease on 2,560 acres of land owned by some 75 Papago Indians. The land will be used for dumping waste materials (gravel and/or tailing) from proposed mining operations on or near the Reservation south of Tucson.

According to Chester Higman, tribal administrative assistant, payments will be made in advance at five-year intervals, each payment being in the sum of $76,800.

The rented land is located in the sections shown on the adjoining map, as are the three tracts for which Asarco was high bonus bidder of $1,066,007.04 in 1957. The bid gave prospecting rights together with options to lease up to 2,560 acres of land in each tract. The two-year prospecting permit is scheduled for expiration this month.

Asarco is known to have discovered, drilled, and done underground exploration on a very large disseminated porphyry type copper deposit. Leaching and secondary enrichment are confined to a thin layer at the top of the Papago formation completely buried under alluvium and caliche. Under the alluvium are calcareous sediments converted to various lime silicate minerals and sulphides by hydrothermal metasomatism.

Pyrite and chalcopyrite are the predominant sulphides. Molybdenite is sparsely and erratically distributed. Hydrothermally altered originally calcareous rocks, tactite, and hornfels contain the most copper. Argillite has less, and quartzite and monozite the least.



1959, page 75), United States District Judge Hatch has enjoined Homestake from processing in the **Homestake-Sapin** mill any ore removed from the Homestake-New Mexico Partners mill, and also from selling any of the Homestake-New Mexico Partners' ore without written consent from all of the partners. Under the decision, **Rio de Oro Uranium Mines** won the right to sell any excess ore from its properties to firms other than Homestake-New Mexico Partners.

The former **Territorial Division of Mines** is now the **Division of Mines and Minerals** under the **State Department of Natural Resources.** Headquarters are still in Juneau, and Phil R. Holdsworth is now Commissioner of Natural Resources while James A. Williams is Director of the Division. Irwin Mitchell is assaying at Anchorage, Ralph Pray is at Ketchikan, and Will Burand has opened an assay office in Nome. A petroleum engineer and a petroleum geologist have been added to the staff, and will be located in Anchorage.

Northern Industrial & Development Corporation Inc. reportedly has let a contract for test drilling of the beach at Skagway for foundations for a proposed smelter. Robert Crowe-Swords of Vancouver heads the group.

Bear Creek Mining Company, Kennecott Copper Corporation's exploration subsidiary, is drilling for its third season on the **Ruby Creek** cooper showing north of the Kobuk River.

A syndicate managed by **Moneta Porcupine Mines Ltd.** of Toronto, Canada is now drilling on a copper property it located last year. The prospect is located above Endicott Arm, between Juneau and Petersburg.

Ed Toussaint has his new mill in northern Alaska's Chandalar district ready for operation on ore from his **Summit** claim. In the same district, Hugh Matheson is placer mining on St. Mary's Creek.

Geochemical prospecting is credited with finding of high-grade, lead-silver ore in extensions of the original ore structure at the old **Mountain Chief** prospect on Plowboy Mountain at the northern end of Upper Priest Lake, Bonner County, Idaho. A four-mile access road has been built for trucking of crude ore from open cuts to the **Bunker Hill** smelter at Kellogg. A log cabin has been constructed, and a 1,000-foot tunnel is being cleaned out with the objective of seeking the downward extension of the ore found by soil testing. Partners in the venture are Kenneth Bagdon, Otto L. Bagdon, Gene C. Bagdon, and Carl Martinson, all of Spokane, Washington.

About 2,000 feet of diamond drilling is planned by **R-G Mining Company** to explore potential ore zones disclosed by drifting at its lead-silver property in the Beaver Creek area north of Wallace, Idaho. An exploratory crosscut started in April 1957, was driven 1,400 feet to intersect a structure which yielded promising surface values. Work has been on a six-day week contract basis since last October. Ray Klepinger of Wallace is president.

Floyd Watts and partners are mining and milling silver-bearing ore at Maiden Rock, one mile south of the old silver mining community of Talache on the shore of Lake Pend Oreille, Bonner County, Idaho. There is no road into the mine. Supplies and equipment are transported by boat.

A depth of 4,170 feet has been penetrated by shaft crews at the **Galena** mine, Coeur d'Alene mining district, Shoshone County, Idaho. Work has started on a 4000-level skip pocket and a new ball mill has been installed. J. C. Kieffer is manager of the Northwestern Mining Department of the operating firm, **American Smelting and Refining Company.**

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Three Squarman Methods for Cutti... NORTHWEST

NORTHWEST

A new $1,500,000 clay-silica plant being constructed near Bovill, Latah County, Idaho, by **J. R. Simplot Company** is expected to go into production in October. Products will include white glass sand, quality clays for paper filler and high gloss paper surfacing, silica for bottle making, flour silica, and finely ground white sand for toothpaste. Phillip T. Peterson is plant manager.

Idaho Mining & Milling, Inc. has completed moving a bucketline gold dredge from Warren, Idaho, to the Florence Basin in Idaho County, where it plans gold dredging operations. A sawmill has been constructed and lumber is being sawed for camp buildings. Philip W. Jungert of Lewiston is president.

Ohadi Mining Corporation of Lewiston, Idaho has been doing exploration work this summer at the **Dixie** mine in Idaho County's Grangeville area.

Basic Metals, Inc. of Golden, Idaho is operating a two-yard dragline and dryland washing plant on Newsome Creek which is on the South Fork of the Clearwater Rim. This is the second gold placer operation to have started in recent months in Idaho. Bud Landon and Clem Cafanelli are owners and managers.

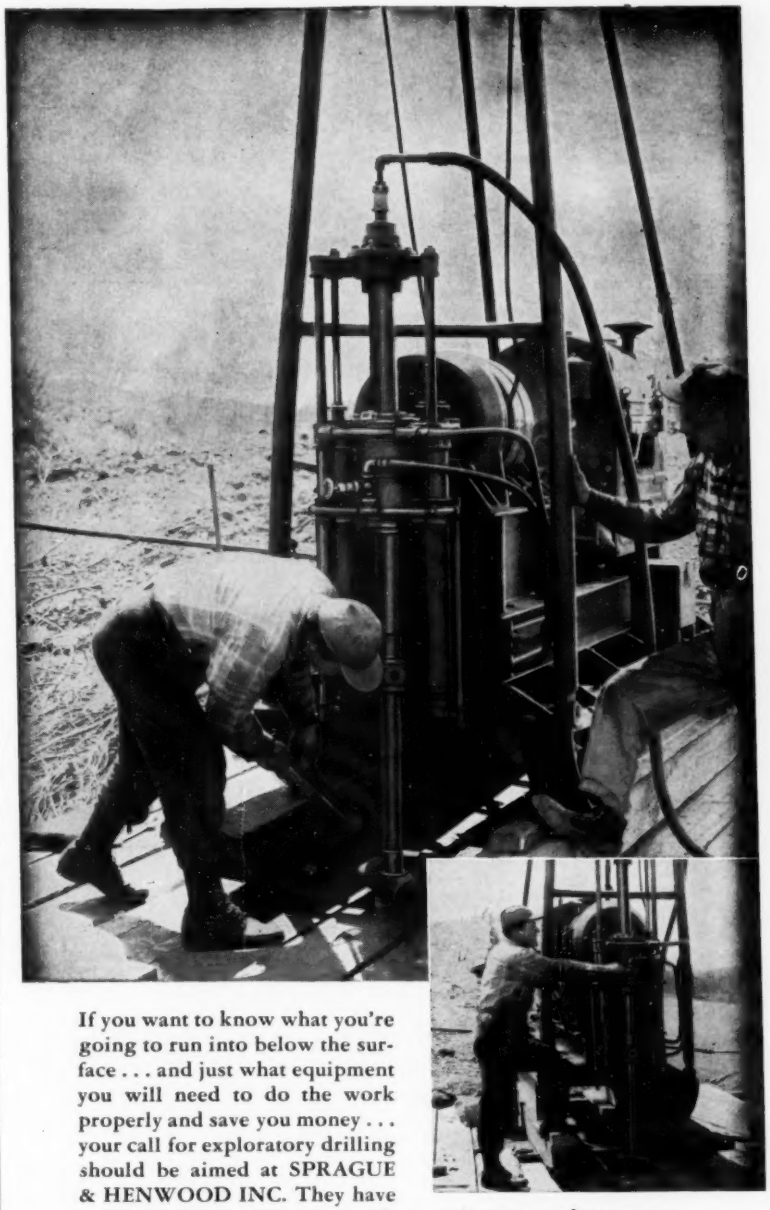
Vitro Idaho Minerals Corporation has been formed by **Vitro Minerals Corporation** and **Western Fluorite Mining Company** to develop and mine uranium properties held by Western Fluorite near Stanley, Custer County, Idaho. The firm, which will have headquarters in Lake City, also will seek new uranium properties elsewhere in the Pacific Northwest. Vitro Minerals is a leading uranium producer in Wyoming.

An electronic quantometer installed in **Bunker Hill Company's** electrolytic zinc plant at Kellogg, Shoshone County, Idaho, analyzes zinc alloys in 40 seconds, compared to three hours by spectrograph and three days by the old wet chemical assaying method. The company also is putting a layer of slag from its lead smelter on its old mill tailings pond to alleviate a growing dust problem.

Idaho's mining industry has given $250,000 to the University of Idaho for a new School of Mines building. A finance committee headed by L. J. Randall, president of **Hecla Mining Company**, raised the money to match a $250,000 appropriation of the Idaho legislature.

The **Anconda Company** is reactivating its **Elm Orlu-Black Rock** zinc development at Butte, Montana for mining of low-grade zinc ore. Full production is expected in about 10 months. The area is being reopened to replace ore presently coming from the **Alice** open pit which is expected to last only another year. The ore, which will be mined by the block caving process, will be hoisted through the **Badger** mine shaft.

YOU'LL KNOW WHAT'S THERE ...BEFORE YOU KNOW IT...



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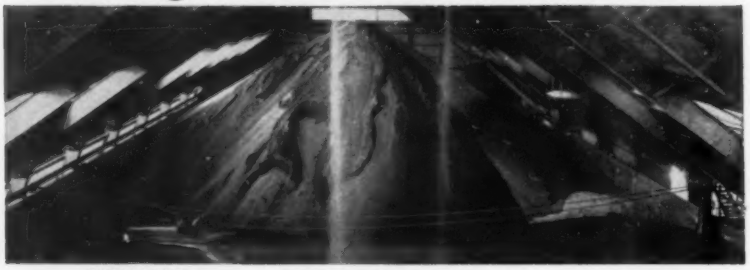
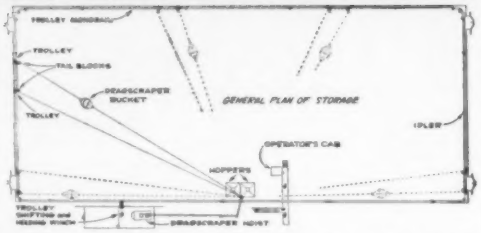


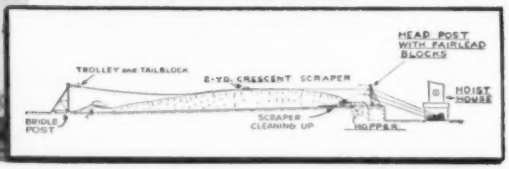
INDOOR RECLAMATION



DragScraper with Trolley and Monorail—Material dropped onto stockpiles from an overhead conveyor is reclaimed to hoppers by a 2½-cu. yd. DragScraper. The installation uses a monorail and trolley system to permit shifting of the scraper bucket by remote control from operator's station at right.—*Sauerman News No. 143.*

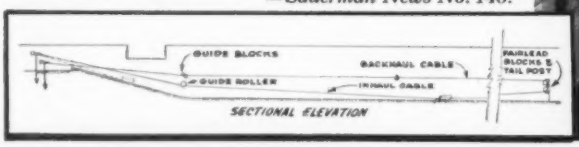
OPEN STORAGE

DragScraper with Trolley and Elevated Bridle—DragScraper is reclaiming raw potash to hopper from storage pile. Material is dumped at rear of the pile and moved closer to hopper during intervals when mill requirements are satisfied. Trolley and tail block travel on an elevated bridle between two stiff-leg bridle posts. Shifting of the trolley is provided by a third drum on the Sauerman DragScraper Hoist—*Sauerman News No. 146.*



HANDLING HOT MATERIAL

DragScraper—Hot scale is dropped from ingot buggy track into tunnel and is conveyed by DragScraper to a water sluiceway for disposal. Safety is important here—personnel and vulnerable equipment do not enter the hazardous area.
—*Sauerman News No. 146.*



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NORTHWEST

An extensive development program is planned at the **Coeur d'Alene Star** and **Silver Bell** groups of mining claims near Eddy Creek, Sanders County, Montana by **Nevada Rawhide Mining Company** of Cheney, Washington. The Coeur d'Alene Star yielded some crude lead-silver ore in 1897 to a New York firm which drove 2,000 feet of tunnel and reached a depth of 300 feet by shaft and winze. Firmer Walkley of Spokane, Wash., will be superintendent of operations at the newly acquired properties. Cline Tedrow, also of Spokane, is company mining engineer. Clarence Davis of Cheney is president.

Crews at the **Jack Waite** mine, preparing to drift under a surface outcrop opened last summer, are drifting on the 300-foot level and doing long-hole drilling in areas considered favorable for ore bodies. This exploration is in addition to normal mining operations. **American and Refining Company** is the operating firm.

The **Carter Creek** iron deposit near Dillon, Montana recently sold by **Minerals Engineering Company** to **North American Utilities Corporation** (see MINING WORLD, August 1959, page 7) contains about 50,000,000 tons ore assured through drilling a small portion of the ore body. According to Minerals Engineering, total tonnage possible of development at reasonable open pit depths is about 200,000,000 tons. This would supply the Canadian venture, at a maximum projected capacity, with about 30 years at open-pit depths. Payments for ore production have been arranged to increase with tonnage mined. This is in order to give a new integrated steel plant a low cost of ore on an initial single blast furnace installation, increasing as the project matures and expands.

Teams working under the **Montana Bureau of Mines and Geology** at Butte, Montana are conducting a number of field projects this summer. Some members are visiting small mines and prospects in various sections of the state, and from this work a "Directory of Known Mining Enterprises in Montana, 1959" will be issued next year. Others are testing clay and shale deposits; studying geology and ground-water resources of Powell, Deer Lodge Hill, Blaine, Judith Basin and Fergus Counties; and analyzing limestone. There will be some mapping, in conjunction with the project of **Great Northern Railway Company** and the **Pacific Power and Light Company**. A new undertaking in a little known area will be the study of geology of the Mill Creek Basin in Park County. All field work is to be finished by September 15.

WASHINGTON

Spokane National Mines, Inc. has undertaken additional drilling exploration of two uranium prospects obtained in a 1957 merger. The properties are section 13 adjoining the **Midnite** uranium mine in the Spokane Indian Reservation and the old **Dahl** uranium mine in the Mount Spokane district of Washington. Previous drilling results were inconclusive. George Allison

of Spokane and Casper, Wyoming is president.

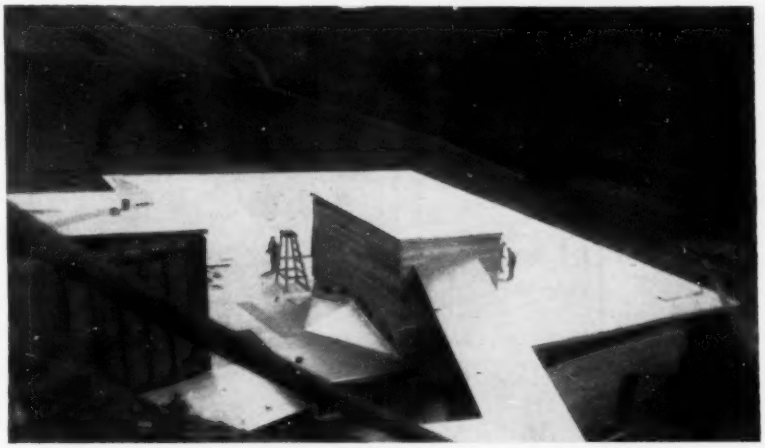
Mudhole Exploration Company is doing development work from the bottom 75-foot level of its new shaft in the Mount Spokane uranium district, Spokane County, Washington, after timbering the shaft. The project is several miles from the firm's original uranium discovery on the south side of Mount Spokane. Adolf C. Nisson is company president, and Roy Shaffer of Sheridan, Montana is mine foreman.

Nevada Rawhide Mining Company has taken a lease and option from Lloyd Jacobsen of Colville, Washington, on the **Tenderfoot** group of lead-silver claims in Stevens County's Clugston Creek district. Diamond drilling exploration is planned under direction of Cline Tedrow, Spokane mining engineer. The company operates the **Pyramid** group of gold-silver-lead claims southeast of Virginia City, Nevada. Clarence Davis of Cheney, Washington is president.

Painted Desert Uranium and Oil Company has diamond drilled to depths of 100 feet since resuming exploration work this year at its Mount Spokane district holdings in Washington. Encouraging autunite cores were reported. Willard Parsons of Worley, Idaho, company president, has been doing the drilling. W. M. Fredericks of Spokane is secretary.

Silver Buckle Mining Company of Wallace, Idaho is the largest custom shipper to **Dawn Mining Company's** uranium mill at Ford in southern Stevens County, Washington. It trucked 4,000 tons of ore to the mill in the first six weeks after resuming open-pit operations this season. Production is from the former **Northwest Uranium Mines'** property in the Spokane Indian Reservation.

Ninety-one new commercial ore discoveries containing reserves valued at about $100,000,000 have been made in the four Pacific Northwest states under the **Defense Minerals Exploration Administration** program started in 1951. This new wealth was discovered with the expenditure of only $7,500,000 in government funds, of which nearly $1,000,000 has been repaid so far in royalties on production, and about $8,000,000 by private industry. Lead, zinc, tungsten, copper, mercury, manganese, mica, uranium, and antimony were the strategic minerals found. A total of 241 projects were approved out of 733 applications but some were not carried out by the applicants for lack of funds. The succesor OME (**Office of Minerals Exploration**) program is getting under way slowly in the Northwest, with comparatively few applications and no approvals to date.



Thorium Ore Concentrator in Operation

Salmon River Uranium Development Inc. of Salmon, Idaho has completed and tested its new mill for concentration of thorium and other ores. The 100-foot by 100-foot building is shown above while under construction. The company has been doing extensive developing work on the Sunnyside thorium claims, including diamond drilling and tunneling to block out the ore. Ore bins and chutes have been completed, as well as installation of complete electrical equipment for handling the ore at minimum cost. While developing and blocking out its own ore, the company will do some custom milling for other property owners. At the present time, the firm has contracted with Volpex Inc. of New Jersey, whose property is located on Agency Creek, to mill its ore. Volpex made its first delivery of ore to the mill on July 13. William Wilcox, president of Salmon River, plans to operate the mill on a full-time schedule.

CENTRAL STATES

Armco Steel Corporation's Sheffield Division has taken options on property in Jackson and Lafayette counties of Missouri for core drilling and prospecting. The options extend for several years, during which time the company will seek to determine whether there is an iron ore deposit of sufficient quantity and quality to make mining economically possible. The area was selected as a result of an airborne magnetometer survey.

Shipments of manufactured zinc products during the second quarter increased 23 percent for **American Zinc, Lead and Smelting Company**, as compared with the same period of 1958. Shipments of all products, including zinc concentrates and stone, increased 21 percent. Shipments of manufactured zinc products also increased 23 percent for the entire first half of 1959, compared with 1958, while shipments of all products, including zinc concentrates and stone, increased 21 percent.

The newly formed **Wisconsin Ore Processing Company** at Platteville, Wisconsin reportedly plans to build a 1,000-ton-per-day processing plant for ore mined in that area. Construction is to start in the fall.

St. Joseph Lead Company's request for a reduction in its assessment value in St. Francois County, Missouri was rejected by the Country Board of Equalization. The firm was seeking a $3,015,300 reduction, that is, a reassessment from the present $12,204,380 valuation to $9,189,080. The Board refused the re-evaluation on the grounds that it was assessed above the 30 percent level. The company will probably turn to the Board of Appeals for reconsideration. For the first six-month period of 1959, St. Joe Lead showed a downward trend in production, but an upward trend in sales, compared with the previous year. Mine production was 67,651 short tons of lead concentrate in the first half of 1959, compared with 74,229 in the same period of 1958. During the same half of this year 3,698 short tons of lead concentrates had been purchased by the company, while 20,698 were purchased last year.

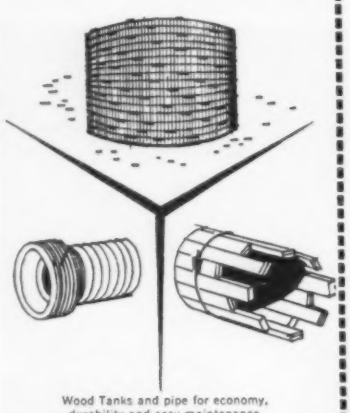
Freeport Sulphur Company has ordered construction of two, 64-foot, 90-passenger aluminum boats. The personnel launches will be used to transport workers to sulphur wells in Louisiana. **Peterson Builders, Inc.** of Sturgeon Bay, Wisconsin has the contract.

Michigan Chemical Corporation of St. Louis, Michigan is now able to supply an electronic-grade yttrium oxide, especially tailored for use in production of yttrium-iron garnets for micro-wave transmission. The company's **Rare Earths & Thorium Division** reports that this particular product has minimum purity of 99.9 percent with respect to total impurities and its uniqueness is characterized by its extremely small particle size (nominally 2-5 microns), and its high reactivity.

Michigan's oldest copper producer, **Quincy Mining Company**, reportedly has resumed production after an 18-month shutdown caused by low copper prices. The Quincy smelter, located at Ripley, Michigan, is producing 25-pound ingots. The firm was founded in 1848 in Michigan's Upper Peninsula area.

The **AEC** has signed a contract with the **Carey Salt Company** for use of a portion of the company's mine near Winnfield, Louisiana for detonation of several nonnuclear high explosive charges. Carey will provide use of certain mine property, equipment, some underground support services, and labor for access tunnels.

Part of the equipment in the **Alice** mine of the **Midcontinent Mining Company** at West Plains, Missouri has been sold to the **Ben Hogan Construction Company** for use on the Dardanelle Dam in Arkansas. The equipment was purchased at a federal foreclosure sale by the **A.**



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CENTRAL AND EASTERN

Tannebaum Company of Little Rock which then offered it for sale. The foreclosure had been brought about at the request of the **General Services Administration** to satisfy a mortgage held by that agency.

The Mining Section of the **National Safety Council** will meet in Chicago, Illinois October 19-22. Sam E. Sharp, director of safety for the **Tennessee Copper Corporation** at Copperhill, Tennessee, will preside over the meeting. Among those scheduled to address the group are representatives of **Bunker Hill Company, Jones & Laughlin Steel Corporation's Michigan Ore Division, Oliver Iron Mining Division** of **U.S. Steel Corporation, Utah Copper Division** of **Kennecott Copper Corporation,** the **U.S. Bureau of Mines,** and the **Mines Accident Prevention Association** of Ontario, Canada.

EASTERN STATES

The **Maine Mining Bureau** has signed its first long-term mining lease. Negotiated with the **Roland F. Beers Company** of Troy, New York, the lease includes about 150 acres of state-owned land. The Beers company plans to continue its exploration program outlining a nickel-copper prospect. It has been exploring in Knox County for more than a year, and also in several other areas of the state. The program has included diamond drilling, electromagnetic survey work, and detailed field mapping.

Reynolds Metals Company placed its first potline in operation at the new Massena, New York reduction plant just two years after start of construction. The new line adds about 33,000 tons to the company's primary reduction capacity. The remaining two lines with a combined capacity of 67,000 tons annually will be completed before the end of 1959. This will bring overall company capacity to 701,000 tons annually.

Alabama Metallurgical Corporation expects initial production of magnesium metal to start in mid-September at its new $3,500,000 plant at Selma, Alabama. Additional furnaces will be put into operation shortly thereafter. The plant will produce magnesium for metallurgical purposes. Initial output will be 6,000 tons annually. The magnesium will be produced from dolomite mined at a company-owned deposit at Ryan, Alabama. **Calumet & Hecla Inc.** holds majority interest in the firm.

New facilities have been installed at **American Smelting & Refining Company's** Perth Amboy, New Jersey plant to increase capacity to produce high purity (99.999 percent) indium. The company had been producing this metal in its Central Research Laboratories in South Plainfield, New Jersey. Increasing demand for its use in electronic applications has necessitated completion of larger production facilities. Asarco also has expanded its General Sales Department to handle sale of increased tonnages of copper. The firm

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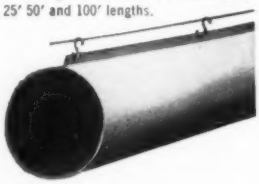

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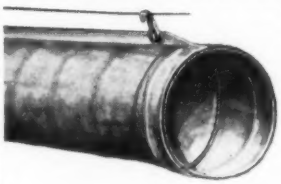

SEND FOR CATALOG

A B C AMERICAN BRATTICE CLOTH CORP.

230 Argonne Rd. Warsaw, Ind.

has contracted to purchase, beginning early in 1960, 4,400 short tons of blister copper per month from **South Peru Copper Corporation.** This will be refined at the Asarco refinery in Baltimore, Maryland, and sold through the Sales Department in New York. Charles Earl has been named manager for copper sales under the general sales manager.

Michigan Chemical Corporation's new magnesium oxide plant at Port St. Joe, Florida has been started up. After the essential in-process build-up, finished products will reach customers early in October. Augmenting extensively its St. Louis, Michigan magnesia operation which will continue to provide industry with high-purity chemical and refractory grades of magnesium oxide for use in manufacturing basic brick and other refractory products, rubber and neoprene, paper, textiles, insulation and building products, ceramics, catalysts, and for many applications in chemical processes.

A technical-economic study for new uses of mercury is underway at **Battelle Memorial Institute** in Columbus, Ohio under the sponsorship of the **American Quicksilver Institute.**

During the past three years, the **American Zinc Lead and Smelting Company** has purchased the mineral rights in 8,157 acres of Tennessee land. The firm now owns in Tennessee, in fee and mineral rights, about 17,000 acres, and has under option another 3,000 acres which are currently being prospected by surface drilling.

IRON RANGES

Western Mining Company of Cleveland, Ohio has been granted mining rights to the iron ore under Cavanaugh Lake near Grand Rapids, Minnesota. This property belongs to the State of Minnesota and adjoins the **Tioga No. 2** properties currently being mined by **Pickands Mather & Co.** for Western Mining. Operations were started on the Tioga No. 2 property in 1955 and have produced nearly 2,500,000 tons of iron ore. The new acquisition requires removal of 110 feet of overburden before mining production is attained.

The steel strike brought iron ore shipments from the Lake Superior district practically to a standstill. All iron mines were idle except the **Zenith** mine of **North Range Mining Company.** Shipments through July 1 were more than double those of a year ago at that date in anticipation of the strike. A total of 28,732,533 gross tons were shipped compared with 12,264,134 in 1958. **Steep Rock Iron Mines Ltd.** and **Canadian Charleson Ltd.** at Atikokan, Ontario, continued to work because they had either signed new contracts or negotiated without work stoppage.

Wisconsin Governor Gaylord Nelson signed several bills into law which are aimed at encouraging development of taconite iron ore mining in the northern area of the state. One permits mining companies to divert water from streams or rivers for an unlimited period, under a permit system administered by the **Wisconsin Public Service Commission.** Another includes in the definition of low-grade iron property, for tax purposes, the mined rock or ore and marketable concentrate stockpiled for shipment. A third sets up income deductions and certain depletion allowances for taconite firms.

Michigan Governor Mennen Williams has also authorized the use of water for operation of low-grade iron ore processing plants, and signed another bill clarifying the law pertaining to taxation of low-grade iron ore properties. Both new acts are the outgrowth of a study of the mining industry by a special legislative committee. (See MINING WORLD, August 1959, page 75 for news of similar action by Minnesota Governor Orville Freeman.)

An underground fire broke out at the **Buck** mine of **Pickands Mather & Co.,** near Caspian, Michigan in July. Some 130 miners who ordinarily would have been underground were out on strike. A mine rescue crew sealed off the fire area so that it could burn itself out without damage to other areas. Cause was believed to be electrical wiring or motors.

A STANDARD dryer plays an important role in R. J. Reynolds Tobacco Company's new research facilities.

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Swedish Stora-Kaldo Rotary Furnace Steel Process Now Available In United States

The Swedish Stora-Kaldo oxygen steel making process which has attracted world-wide metallurgical interest because of its high operating efficiency and low installation cost, has been brought to the United States and Canada by Dravo Corporation.

Developed by Stora Kopparbergs Bergslags Aktiebolog, 600-year-old Swedish miner and producer of steel and chemicals, the process features the use of an inclined, variable speed rotating furnace for the reduction of pig iron to steel.

Based on operating experiences at the Swedish company's Domnarvet Works, northwest of Stockholm, it is estimated that a Stora-Kaldo installation in the United States or Canada will cost between 50 and 65 percent less than a new open hearth shop with similar capacity and auxiliaries.

Although the Stora-Kaldo process was developed primarily for the production of steel from Sweden's high phosphorus iron ore, its ability to produce top quality steel in a broad range of specifications from low phosphorus iron has been thoroughly proved. It is ore of this type which is used generally by the steel industry on this side of the Atlantic.

Physical shape of the Stora-Kaldo furnace resembles a conventional Bessemer converter. The Swedish furnace shown in drawing, is rotated at variable speeds up to 30 revolutions per minute at an inclined angle of 17° from the horizontal with an oxygen pressure of 40 to 50 pounds per square inch injected into the vessel through a water-cooled lance. Pressure at which oxygen is injected into the furnace produces a quiet reaction and consequent reduction of iron loss in exhaust gases and slag.

Variation of the rate of vessel rotation and its consequent influence on slag composition and temperature, produces a slag with controllable chemistry. It also contributes to high yield.

In addition, the ease with which carbon elimination in the refining process can be stopped at a predetermined point minimizes time required for carbon control, and eliminates the necessity for recarburization.

Combustion of essentially all carbon monoxide to carbon dioxide within the furnace minimizes gas volume and the cost of gas cleaning. At the same time it permits melting of large quantities of iron ore, sinter, or scrap during the refining process, thus producing a high steel tonnage per ton of molten pig iron charged.

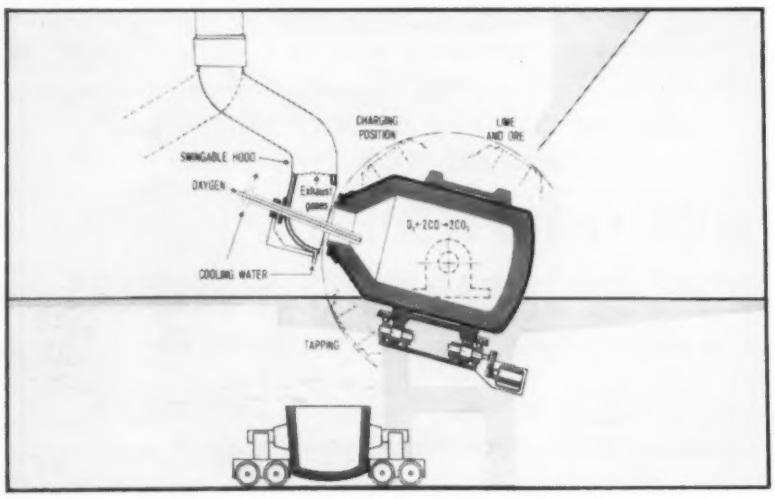
West African Ores Attract Foreign Mining Interests

The mineral wealth of the Gabon Republic on the African West Coast continues to attract foreign interest. The recently formed Iron Ore Company of Mekambo, based at Libreville, includes as shareholders the Bethlehem Steel Company, owning 50 percent of the stock, the Banque de Paris, the Suez Canal Company, the Italian Fiat Company, as well as Dutch, Belgian, German, and other French metal interests.

The new company plans to determine over a five-year period whether sufficient high-grade iron ore exists to warrant building a 700-kilometer railroad and a new port for iron ore shipments from northeast Gabon. The Mekambo deposits are considered to be among the world's richest. 20,000,000 tons of ore have been proved in the Boka-Boka hills of the area, but a minimum of 500,000,000 tons with 60 percent iron content is needed to justify the expense of a tortuous railroad through tropical forests to Pongara at the mouth of the Gabon River.

Manganese deposis at Moanda in Gabon are believed to be second only to those at Nikopol in the Soviet Union. The republic has given an exclusive development grant to the Ogooue Mining Company (COMILOG), with the proviso that Gabonese deposits must be developed before commencing any operations in the Congo Republic. United States Steel Corporation owns the controlling interest in COMILOG. The French Overseas Mining Office, the Compagnie Miniere de L'Oubangui Oriental, and Mokata El Hadid also own interests. Responsibility for opening roads to the site of the two hydroelectric plants, on the Couilou and Sounda Rivers, has been undertaken by the French community. The dams are sited on the borders of the republics of Gabon and Congo. COMILOG has awarded Utah Construction Company a contract to build railroad.

At Franceville, in the Gabonese interior, a $10,000,000 uranium concentration plant is planned by the Franceville Uranium Mining Company, formed last year to develop a deposit located near the village of Moanda, northwest of Mekambo. Exclusive uranium mining rights have been granted to the company for the next 25 years. The deposit crops out over an area of 2,500 square meters.



Canadians Will Explore For New Zealand Gold

Exploration and development of long-neglected gold fields in New Zealand will be initiated in the immediate future by South Pacific Mines Ltd., headquartered in Vancouver, British Columbia. The new company will operate in and around the area of Thames on the Coromandel Peninsula, located on the east coast of New Zealand's North Island. The Peninsula is the site of many bonanza-type mines which were worked during the years 1867 to 1910.

The company holds nine claims in the area, covering old mines and unexplored fault blocks near the town of Thames, and a mine on which one mile of drift has been driven on a vein near Maratoto. In addition, the company has three placer claims on the Ohinemuri River where early mills discharged their tailings. A considerable amount of the original gold remains in the 5,000,000 tons of tailings which were discharged into the Ohinemuri River. Testing of samples from these claims indicate that modern milling methods will give a recovery of nearly 90 percent of the remaining gold.

The New Zealand government has given "unqualified" assurance that no obstacle will be placed in the company's way of withdrawing profits, or invested capital, in dollar funds.

Bruce W. Barnett of Auckland is president and managing director of South Pacific Mines Ltd.

India Plans $12,000,000 Zinc Smelter at Udaipur

A $12,600,000 zinc smelter is to be installed at Udaipur in Rajasthan by the Metal Corporation of India, with the technical and possible financial aid of Rio Tinto Company Ltd. of London. Machinery will be supplied by the Paris firm of Krebs-Pennaroya under the Indo-French credit agreement.

Initial capacity of the new smelter is planned for 15,000 tons of electrolytic zinc, 60 tons of cadmium, and 27,000 tons of sulphuric acid annually. The corporation's present zinc-lead-silver ore output at Udaipur averages 500 tons per day, which will be increased to 1,200 tons per day by 1961, according to plans.

INTERNATIONAL

It hopes to double production by 1965 and increase the smelter capacity to 30,000 tons per year.

Financial participation of the British firm depends on New Delhi's Central Board of Revenue's exempting inter-corporate dividend tax payments on the project. Such exemption will be granted if the Board affirms that the undertaking involves one of 20 key industries. India's present demand for zinc in all forms is estimated at 40,000 tons per year and is expected to increase to 50,000 tons by early 1960's. India exports concentrates to Japan for smelting at the present time.

EUROPE

SWEDEN—Production of iron concentrate is underway at the **Strassa** mines, following completion of the beneficiation plant this month. Closed since 1923, the Strassa mines were reopened in early 1950's by **Trafik ab Granesberk Oxelosund.** Granesberk rehabilitated the main shaft, recently sank another shaft to a depth of 80 meters to serve as the main production shaft, and completed a concrete headframe 50 feet high. First lowering of personnel with the new Koepe hoist delivered by ASEA began early this year, and underground crushers were in operation by July. It has taken the company three years since initial planning.

NORWAY—A new sulphuric acid plant at **Mo i Rana** will be erected by **Bleikvassli Mines** for utilization of pyrite from the **Rana** iron mines. Planned annual capacity is 40,000 tons of sulphuric acid.

SPAIN—A concession reportedly granted to **Cia Siderurgica de Ponferrada** will enable the company to carry through its plan for a blast furnace near Ponferrada in Leon Province with a total capital of Pesos 1,913,000,000. Machinery costs are estimated at Pesos 381,000,000. The blast furnace will use 160,000 tons of iron ore annually.

RUSSIA—Mineral output for the first quarter of 1959 showed a total increase of 11 percent over the same period last year. Steel production reached 14,500,000 metric tons, a nine percent rise. Iron ore production increased seven percent, with an output of 22,600,000 tons. Sulphuric acid production rose six percent, with 1,300,000 metric tons. Among other items exceeding the first quarter production plan were refined copper, lead, zinc, and slate.

SWEDEN—**Baskarns Gruvab** has completed a new beneficiation plant to raise the iron content of the ore with 4.0 percent manganese and about 42 percent iron content. The new plant, to be in operation shortly, should raise the iron content to 64 percent. Concentrates will be much easier to market than low-grade ore.

NORWAY—Following favorable drilling at **Lokken Verk** which led to the discovery of an extension to the main ore body, decision has been made to sink an exploration shaft 900 feet to the occurrence. Later, the shaft may be deepened to 1,200 feet.

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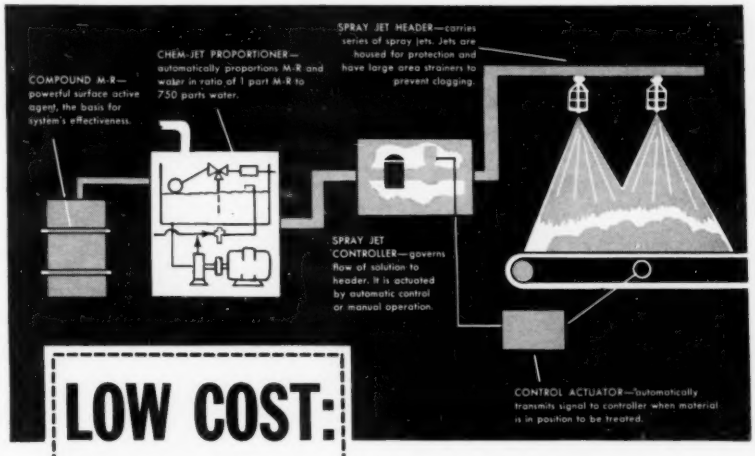
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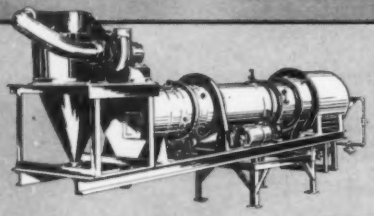
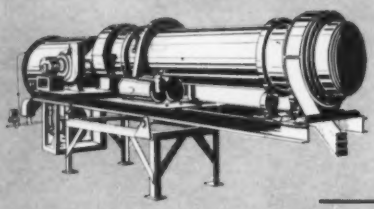


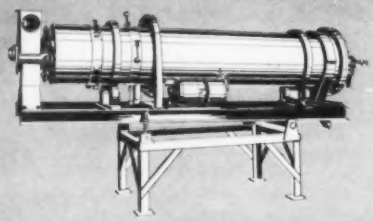
SINGLE-SHELL DRYER

Single-shell, direct gas fired rotary dryer. Arranged for either parallel or counter-flow operation. Mounted on structural steel base. Has removable "knockers." Bulletin AH-471.



DOUBLE-SHELL DRYER

Double-shell, indirect-heat, gas-fired dryer for drying without contamination. Volatiles removed with only limited dilution. Shell rotation speed and shell slope easily changed. Bulletin AH-472.



STEAM TUBE DRYER

Steam-tube indirect heat dryer. Can be connected to any available steam supply or furnished with a 3-HP steam generator. Available in stainless steel or other corrosion-resistant materials. Easily moved from place to place. Bulletin AH-473.

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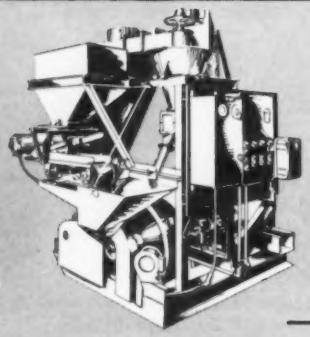
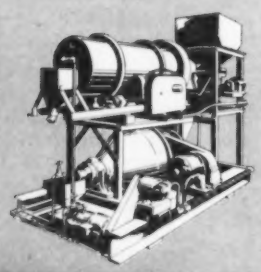


DRY GRINDING UNIT

Make power connections only and the Hardinge Dry Grinding Unit is ready to perform. Self-contained and portable, 7' 8" high. Complete with Constant-Weight Feeder, Conical Mill, "Gyrotor" Classifier, dust collector, product collector and "Electric Ear" grinding control. Bulletin AH-448.



WET GRINDING UNIT

Power and water connections only are needed to put the Hardinge wet grinding unit into operation. Self-contained and portable, 6½' high. Includes Conical Mill, Counter-Current Classifier, launders, feeder, pump and "Electric Ear" grinding control. Bulletin AH-448.

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INTERNATIONAL

UNITED KINGDOM—An airborne magnetometer survey of more than 22,000 square miles of the United Kingdom is now in progress. Supervised by the Geological Survey and Museum, the work covers 7,000 square miles in Ireland, 10,000 in northern England and southern Scotland, and about 3,000 square miles of adjacent areas of the Irish Sea. The entire land area has been geologically mapped, and certain parts have been surveyed by gravity meter, ground magnetometer, and seismic methods. The air survey data will be compared and correlated with that of the ground surveys.

EAST GERMANY—Expansion is planned for central Europe's largest nickel mine at Saint Egidien, near Kuhschnappel in the Granulitgeberge. Production will begin in 1960.

YUGOSLAVIA—According to long-range plans for iron and steel production, iron ore production must reach nearly 6,000,000 tons by 1972. A gradual increase in the production of all plants and the erection of two new iron plants is expected to bring pig iron output to 2,400,000 tons by 1972, and steel production to 3,100,000. Over the past 20 years, the country's pig iron production increased from 101,000 tons to 748,000 tons. Steel production increased from 235,000 to 1,119,000 tons.

EIRE—Exploration for copper has been discontinued at Hollyford, in County Tipperary, Roaring Water Bay district in County Cork, at two places in Kerry, and in Counties Meath and Mayo. Exploration for lead has also stopped at Tassan in County Monaghan. Survey work continues for lead, zinc, and copper at Barrenstown, County Wexford; Keeldrum, Glentogher, Kilrean and Fintown in County Donegal. Surveys for lead and zinc continue at two places in County Kilkenny and at Glendalough, County Wicklow.

THE NETHERLANDS—A new sulphuric acid plant at Pernis, near Rotterdam, Holland, will be jointly built by the **Cyprus Mines Corporation** of Los Angeles, California and the **Albatros Sulphuric Works** of Utrecht. The plant will have a capacity of 120,000 tons of concentrated sulphuric acid. **Albatros'** present four existing plants have a combined capacity of 150,000 tons.

FRANCE—Under terms of an agreement signed by the **Consolidated Zinc Corporation, Ltd.** and the **Societe Miniere et Metallurgique de Penarroya,** the Imperial smelting blast-furnace process for lead-zinc ores will be installed at Noyelles Godault in Northern France. The new plant is expected to begin operations in 1961.

SPAIN—Although exports of metals and metal products have increased in the past few years, a survey by the **Organization for European Economic Cooperation** finds the Spanish ore mining industry lagging behind its status in pre-war years. In spite of rapid growth in Spain's iron and steel industry, iron ore production is 5,500,00 tons a year, only half what it was in 1907 and about 1,000,000 tons less than the 1929 output. Pyrite output last year was 2,000,000 tons, com-

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Haulpak gives you a hauler built to heavy *earth-moving* standards, not merely *automotive* specifications. Many parts and assemblies are identical to those used on thousands of jobs on famous LW Tournapulls. With Haulpak, your maintenance, repair, and operating costs will drop to a new low . . . and your hauling tonnage will climb to new highs.

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- 22, 27, 32 ton capacities
- 290, 335, 375 hp
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- Lube checks of just 4 grease fittings needed only at 500-hr intervals
- Exclusive LW Power-transfer differential

Although brand new, Haulpak is fully field-tested. These machines have been put through rugged tests under tough construction jobs. Here a Model 27 Haulpak gets a heaping load on working conditions for over 14 months—in mines, quarries, and on one of its "test" assignments.

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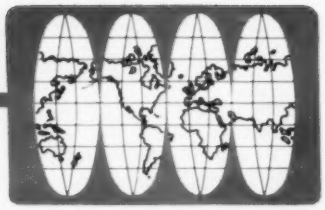

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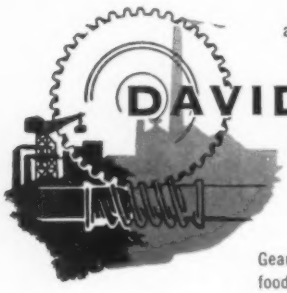

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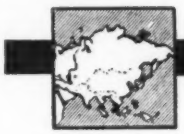
pared with 4,000,000 tons in 1929. Lead ore production in 1928 amounted to 124,000 tons in terms of metal content, and last year's total output of lead reached only 94,000 tons. Blaming post-war factors in Spain's economy, including legal provisions limiting foreign capital investment in industrial and mining enterprises plus a fast growing domestic demand, the survey recommends reforms essential to bringing the relationship between costs and prices into line with the real state of demand and production.

YUGOSLAVIA—Iron ore deposits estimated at several million tons have been discovered on the slopes of Klatibor Mountain in the Serbian part of Yugoslavia.

RUSSIA—Development of tin deposits has started at Solenechni, near Komsomolsk-on-Amur. The Amur River borders northeastern Manchuria. A new mining town is under construction near the site.

FRANCE—In 1958 **Sidelor** produced 7,290,000 metric tons of iron ore, compared with the 6,585,000 in 1957. It also produced 1,849,000 tons of pig iron, compared with 1,833,000 in 1957, and 1,960,000 tons of raw steel, compared with 1,907,000 in 1957. All of this output came from its own operations and from its share in **Sollac.** The latter is a merger of nine leading iron and steel firms which took place about 10 years ago.



ASIA

JAPAN—To cope with increased demand in recent months for ferronickel, **Nippon Mining Company** is increasing its output to 300 tons per month by enlarging production capacities. The presently idle No. 2 furnace will be enlarged from 90 to 175 ton capacity by October. The firm has also been operating its new 140-ton furnace since May, while its No. 3 furnace is capable of producing 100 tons monthly.

INDIA—Vast reserves of gypsum in Kashmir State have been mapped by the **Geological Survey of India.** The deposits have indicated reserves of 25,510,000 tons to a depth of 100 feet, and a mineable reserve of 15,310,000 tons for the same depth, according to the survey group. Further exploration is continuing.

BURMA—**Anglo-Burma Tin Ltd.** is considering sale of half of its half share in the firm to the Burmese government in order to raise £180,000 in additional funds. (The company is now a joint venture of Anglo-Burma and the government.) The government would then procure 75 percent of the amount of new money needed and the company would put up 25 percent which would roughly equal the sum received for the share sale.

JAPAN—Three Japanese ferro-chrome producers have contracted with Turkey for the purchase of 9,000 tons of Turkish chrome ore. The shipments will be made this year to **Showa Denko, Tekko-sha,** and **Nippon Electrolytic Metallurgical** companies. The import price was fixed at

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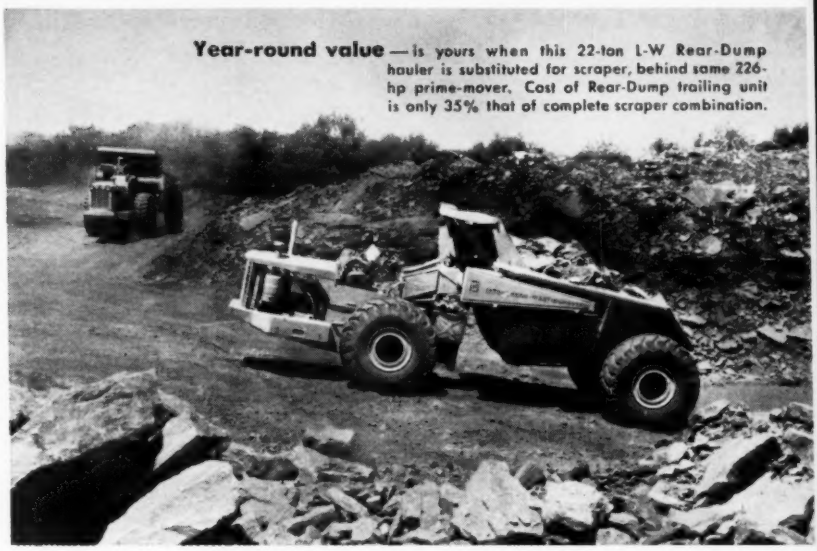
Efficient stripping — is certain with this easy-loading 20-ton (18-yd) scraper. Large bowl capacity, and machine's easy maneuverability, speed removal of overburden. Use scraper, too, to repair old haul roads and build new ones, clean up odds-and-ends of earthmoving on your property.

For shallow stripping, this scraper's your best bet

gives you year-round service with interchangeable L-W Rear-dump



Year-round value — is yours when this 22-ton L-W Rear-Dump hauler is substituted for scraper, behind same 226-hp prime-mover. Cost of Rear-Dump trailing unit is only 35% that of complete scraper combination.

Time means money when you're stripping varying depths of overburden in your pit. If overburden is free of rock, and is shallow and wide-spread, crawler-type excavators—such as shovels, draglines and crawler dozers—move slowly to new work areas, increase your costs. Furthermore, they can only dig and cast . . . require other machines to haul spoil to out-of-the-way disposal areas.

Self-propelled scrapers move shallow, non-rocky overburden at lowest cost per ton. Since stripping is a periodic job, most scrapers are sidelined many days during the year because there is not enough steady work. Not so with LeTourneau-Westinghouse C Tournapull®. When you finish stripping, you simply interchange its 18-yd scraper for a 22-ton Rear-Dump trailing unit. Thus your 226-hp L-W prime-mover works productively for you all the year-round for greater profit.

Cost of the interchangeable hauler trail unit is only 35% of that of prime-mover and scraper combinations. Other interchangeable L-W work units include Bottom-Dump, Side-Dump, and Flatbed haulers.

Tournapull "extras" speed operations

All off-road L-W Tournapull units have easy maneuverability for work in restricted quarters, instant electric control of all work functions. They have powerful brakes (largest in the earthmover field), dependable power-steer, and exclusive, power-transfer differential which keeps these machines working in soft going when other haulers bog down.

All-around usefulness, and interchangeability of hauled units make L-W 'Pull† a sound investment for your pit. Ask for complete specifications, and a demonstration.

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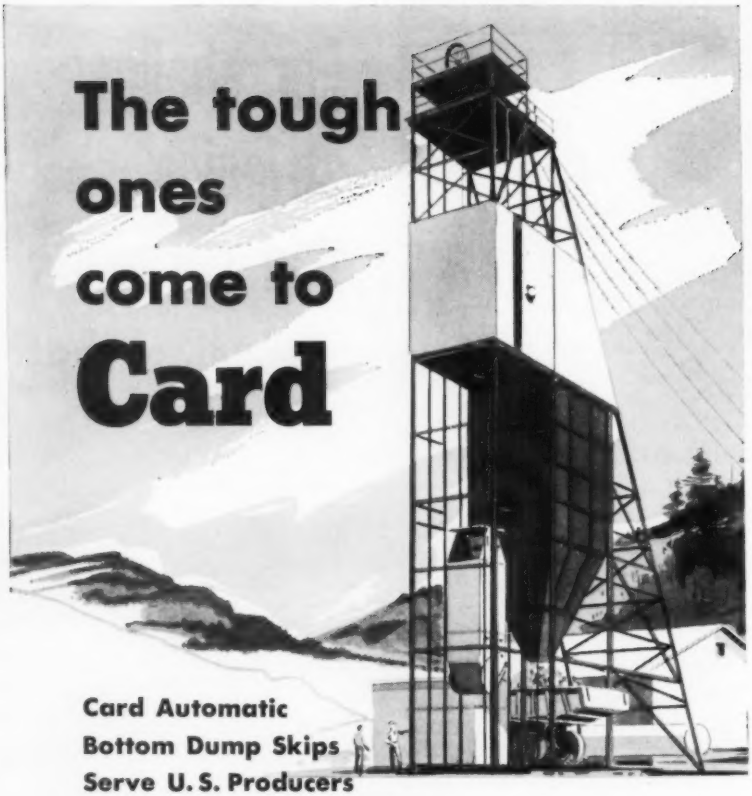

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This is a progress report on a relatively new idea. Beginning in 1956, increasing demand for the new Card automatic bottom dump skips has gradually brought them into service in a majority of the nation's principal mining areas—from Arizona to the Canadian line. In a typical operation two of these Card skips of approximately 150 cu. ft. capacity each are used to haul ore up a thousand-foot three-compartment shaft at a rate in excess of 900 tons per day.

In the initial year of operation, in one such installation, these automatic skips carried over 270,000 tons of rock before needing attention other than routine maintenance. The same successful design will prove out in your next project. It can be adapted to any capacity and specifications with ease.

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about $41 per ton c.i.f Japan, for ore containing 48 percent Cr. This was the first Japanese import of Turkish chrome in several years. Principal suppliers have been the Philippines, India, Pakistan, and South Africa.

SOUTH KOREA—A survey group led by the director of the **Central Soil and Mineral Laboratory** of the **Ministry of Commerce and Industry** and the acting director of the **Mining Division** of the **Office of the Economic Coordinator** test drilled a mine of the **Sannae Nickel Mining Company** in June. The work confirmed that the property, located at the foot of Mt. Chi-ui, Cholla Namdo, contains 1.5 to 2.0 percent nickel. The survey also confirmed that the deposit is large enough to supply ore for the next 10 years at a rate of 50 tons per day.

KOREA—The No. 1 furnace of the Samwa Iron works has gone into operation. The firm hopes to produce 1,000 tons of pig iron monthly at an additional cost of HW900,000,000. By March of 1960, the firm expects to have all of its eight furnaces in operation.

JAPAN—The steel industry plans to import 10,300,000 tons of iron ore in the current fiscal year, compared with 7,580,000 tons in the 1958-1959 year. The increase is to enable the mills to step up pig iron output from 6,690,000 tons in the 1958-1959 period to 8,600,000 tons in the current fiscal period. Some 8,100,000 tons of the planned amount are already ordered; 3,350,000 tons from Malaya, 1,900,000 tons from Goa, 1,200,000 tons from the Philippines, 880,000 from Canada, 400,000 from the United States, 330,000 from Brazil, and 120,000 from Africa. The mills also plan 2,200,000 tons imported from Canada, Hong Kong and other sources. It was reported recently that the Union of South Africa had offered to sell Japan about 400,000 tons of iron ore this year. In the past, purchases had been limited to about 20,000 tons annually. The quality of the South African ore and the low freight rates to Japan are supposed to be particularly appealing.

ONTARIO—**Anaconda Company (Canada) Ltd.** has signed an agreement with the **J. E. Ayrhart** interests involving 584 claims in the North Caribou Lake area of northwestern Ontario. Initially, the firm paid $10,000. This is to be followed by a $15,000 payment every four months for two years. Then, at the beginning of the third and fourth years, additional payments of $25,000 will be made bringing the total to $150,000. Anaconda has the right to purchase any or all of the claims at any time by paying any outstanding balance of the above sum, plus $5,000 per claim for any retained. Anaconda must also pay the difference between the total of the above amounts and an escalating purchase price which is $2,000,000 until July 20, 1961. Thereafter it goes up by $500,000 per year until a maximum of $5,500,000 is reached. The Ayrhart group has retained a 72-claim group at Randall Lake

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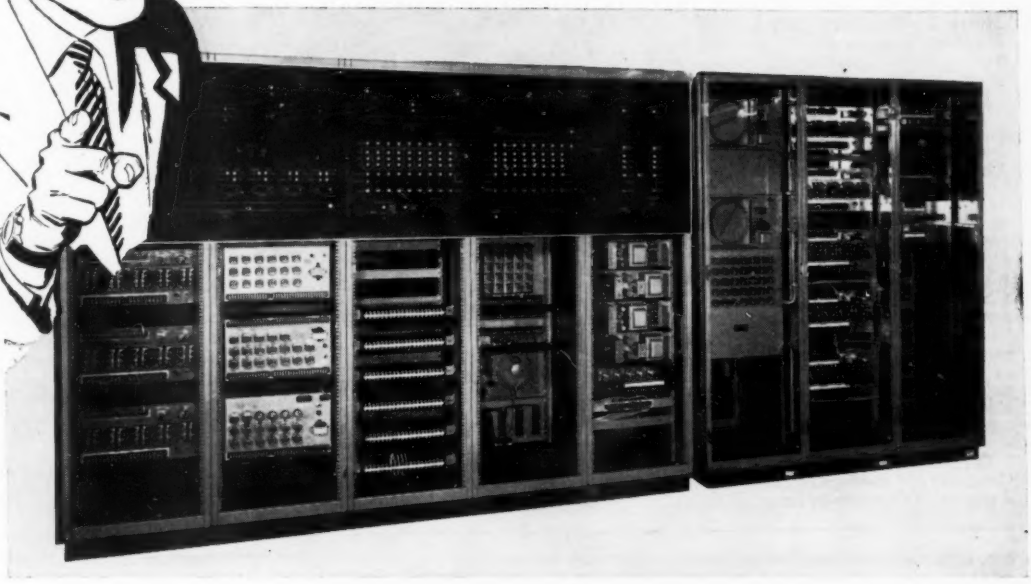

How IPEC CONTROL SYSTEMS bring MATERIAL SAVINGS to material handling methods

This IPEC CONTROL SYSTEM is designed to keep a complicated 2500 TPH copper cycle working smoothly at the western mill of a major copper producing firm. Automation for the ore-handling sequence at this plant is set-up in advance and one man at the central control panel can oversee the combined operations of storage, sampling and blending of several combinations of mill feeds.

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where high values in gold, silver, and copper have been found in preliminary work. This will be investigated further.

BRITISH COLUMBIA—**Kennco Exploration (Western) Ltd.**, subsidiary of **Kennecott Copper Corporation**, has taken an option on 70 claims in the Highland Valley copper camp. The firm has 18 months in which to carry out development work. If the option is exercised, Kennecott will pay $1,000,000 out of production to the owners of the claims, **Minex Development Ltd.** and **Amador Highland Coppers Ltd.** Kennco has been very active in the district for several years.

QUEBEC—The German option on **Ungava Iron Ores of Canada** reportedly has been dropped by **Ferrum Investments Ltd.**, a firm representing **Fried. Krupp** of Essen, **Hoesch Bergwerk** of Dortmund, **Mannesmann Roehrenwerke** of Dusseldorf, and **Hueterwerk Oberhauser** of Oberhausen. For the past two years, the German association has shared exploration and development costs equally with **Champlain Mining Corporation** which represents the **Cyrus S. Eaton** interests. The Germans are still interested in the project, but feel that more investigation of the iron ore property is necessary before a larger investment can be considered. (See Mining World, October 1958, page 73.)

ONTARIO—The **International Nickel Company of Canada, Ltd.**, has established a research fellowship in honor of the visit of Her Majesty, Queen Elizabeth II, and His Royal Highness Prince Philip, Duke of Edinburgh, to the nickel mines in the Sudbury area of Ontario. Pictured here

are the Royal Couple during a mining demonstration on their tour of the **Frood** mine. The Queen is being shown a chunk of nickel-copper ore, taken from a muck pile on the 1,000-foot level in a drift heading, by Henry S. Wingate, president, and Ralph D. Parker, vice president, of Inco. The fellowship will enable the successful candidate to follow an original line of research in earth sciences. It will be a post-doctoral tenable for two years. Inco has deposited $15,000 with The Canada Council which will supervise all arrangements. Applications should be made to the Council at 140 Wellingston Street in Ottawa by January 15, 1960. The award is to be made on or about March 1.

SASKATCHEWAN—The **Gunnar Mines** reportedly will sell six tons of uranium concentrates to the **Japanese Atomic Fuel Corporation.** The purchase is being made under the Japanese-Canadian agreement for cooperation in the peaceful uses of atomic energy, and is said to be the first large sale of Canadian uranium to a foreign country other than the United States. The concentrates would be refined into uranium ingots for the atomic reactor being built at Tokai Village, Japan's atomic center.

QUEBEC—In anticipation of installation of its dredge, **Beauce Placer Mining Company** has purchased a dragline which is now clearing off the earth and low-grade material which covers the pay gravels. This operation is along the Gilbert River in the Chaudiere Valley region, 50 miles south of Quebec City. Exploration is underway with four drills outlining additional yardage. The firm hopes to outline sufficient yardage to justify operation of two dredges.

BRITISH COLUMBIA—Underground work at the **Craigmont Mines** property has already confirmed more than half

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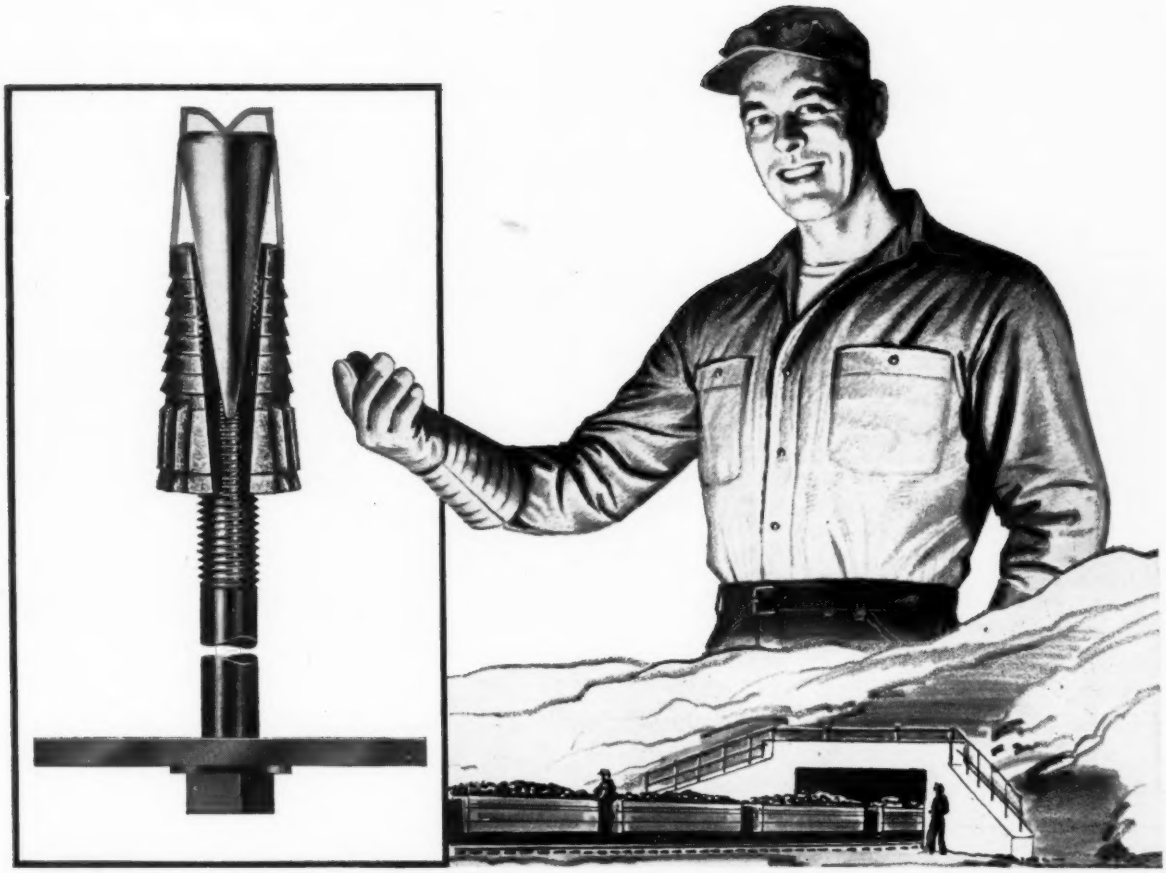

CF&I Rock Bolts with Pattin Shells give maximum anchorage

The Image of CF&I stands for a line of quality steel products that are prominent in the mining industry.

One of these—CF&I Expansion Rock Bolts with Pattin Shells—are widely used because of several exclusive design features. The double expansion of Pattin Shells gives parallel contact along the entire length of the hole, thus ensuring maximum anchorage in any type of rock. The Pattin design provides a maximum resistance to load with minimum displacement.

High strength steel—made to American Standard Specifications for roof bolting materials—provides an ample factor of safety. And CF&I Rock Bolts have been fully safety-tested, thoroughly proven in use.

Maximum utilization of available work space and ventilation facilities is possible with CF&I Rock Bolts, since cumbersome, space-consuming timbering methods are often unnecessary. When used with CF&I's Realock Metallic Fabric for lagging, CF&I Rock Bolts offer proved initial-cost savings up to 35% over timber set costs.

CF&I Rock Bolts with right hand threads are available in ¾″, ⅝″ and ⅞″ diameters, and in four different sizes of Pattin Shells. The ¾″ bolts are also made with left hand threads for tightening by drilling machines.

CF&I also makes a complete line of 1″ Wedge Type Rock Bolts, as well as ¾″ expansion type slusher pins.

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In the East: **WICKWIRE SPENCER STEEL DIVISION**—Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia

of the previously estimated 14,700,000 tons, averaging 1.82 percent copper and 17.3 percent iron. Completion of the lateral work and drilling on the 3,500-foot horizon will permit new calculations which the consulting firm of Chapman, Wood, and Griswold expects to be close to previous estimates. The operating companies of **Noranda Mines, Canadian Exploration,** and **Peerless Oil and Gas** are expected to bring the mine to production, according to the Craigmont secretary, N. H. McDiarmid. To confirm the depth extension, a second adit is being driven at the 3,000-foot horizon, about 500 feet below the present level.

MANITOBA—**Explorers Alliance** is now milling about 60 tons per day at its gold property in the Herb Lake. Current mill feed is coming from surface dumps left by previous operators. Because of a power shortage, the firm has not undertaken dewatering of any of the old workings yet, but expects to do this this fall. Underground reserves are estimated at 26,000 tons of 0.75 ounce gold per ton.

NEWFOUNDLAND — The **Atlantic Coast Copper Corporation** is now planning to put its copper property in the Notre Dame Bay area of northern Newfoundland into production by mid-1960, if further work on crosscuts from the 1,000-foot level confirms the encouraging results to date. The mine was first opened in 1878 but closed in the 1890's when copper prices dropped. Dewatering of old workings is still in progress, and the company has sunk a new shaft to 1,000 feet. Tonnage indicated by diamond drilling around the old mine workings is about 2,610,000 tons grading 2.11 percent Cu.

BRITISH COLUMBIA—A new 75-ton-per-day concentrator has been placed in operation at the **Phoenix** copper mine near Greenwood by **Granby Mining Company.** The firm was formerly called **Granby Consolidated Mining, Smelting and Power Company Ltd.** In the area seven miles southwest of Rossland, **Mid-West Copper and Uranium Mines Ltd.** has reopened the old **Velvet** copper mine.

YUKON TERRITORY—Driving of its new underground adit is well underway by **Canol Metal Mines** on its molybdenite property at Stormy Mountain in the Pelly Range, about 90 miles northeast of Whitehorse. The company plans to spend $240,000 this season in drilling and testing the mineralized zone indicated by previous surface work. (See **Mining World,** May 1959, page 79.)

NEW BRUNSWICK — **Consolidated Mining and Smelting Company** expects to spend $1,400,000 developing its new copper discovery in the **Wedge** group, 28 miles southwest of Bathurst. A 1,150-foot shaft will be sunk, and lateral development work will be carried out on the 500- and 900-foot levels.

NEWFOUNDLAND — The **Buchans** mine which has been operating since 1926 as a wholly owned subsidiary, is now a unit of **American Smelting and Refining Company.** The gold, silver, copper, lead, and zinc producer was formerly the **Buchans Mining Company Ltd.** Zinc is the principal component of the ore, accounting for about 12 percent. ASARCO has been developing, financing, and managing the property since 1926 when it signed an agreement with the **Anglo-Newfoundland Development Corporation.**

SASKATCHEWAN—Latest potash find in the Esterhazy area is that of **Tombill Mines** which has been examining property near Welby under option from **S.A.M. Explorations.** Core drilling has disclosed ore at the 2,880-foot depth, about the shallowest found in this new district so far. The adjoining mine of **International Minerals and Chemical Corporation** is about 300 feet deeper, and **Potash Company of America's** mine near Saskatoon is about 500 feet deeper. Further drilling will be carried out on the Manitoba side of the property to select the best site of shaft sinking.

LATIN AMERICA

CHILE—**Noranda Mines Ltd.** of Toronto, Canada has purchased the **Paposa** copper mine north of the Chilean port of Taltal from the **Sociedad Latorre Prenafeta** of Antofagasta. Reportedly the firm paid $530,000 for the mine and plans to spend $3,000,000 in development.

MEXICO—On behalf of the Mexican government, the West German firm of **Fried. Krupp** has investigated the iron ore deposits of the Las Truchas region in the state of Michoacan and reports that they are adequate for erection of a steel plant. Krupp is willing to supply equipment, technical know-how, and long-term credit for the plant's construction if the Mexican government requests such assistance.

CHILE—The **Cia. Salinera Punta del Lobos, S.A.,** operating south of the city of Iquique, has almost completed construction of its mechanical loading dock as part of a new expansion program. The new system is expected to go into operation before the end of the year. Company officials say that several new markets have been developed with contracts in Europe and Japan for rock salt from Chile.

MEXICO—The **Nomura Mining Company** of Japan is negotiating with **Minas Asociadas del Sur** regarding a joint venture. Minas Asociadas has quicksilver operations which the Japanese firm would like to participate in and expand. Increased production would then go to Japan.

PERU—The **Rosénshine** interests have taken an option on the Huanillos group of mines near the port of Tocopilla. This group of mines was one operated for high-grade mineral which was smelted at the old port of Gatico. Considerable dumps remain and a sizable deposit of sulfide mineralization is believed to exist. Exploration is under way. Rosenshine also has an interest in the **Santander** mine

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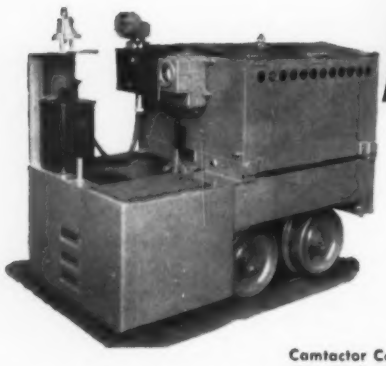

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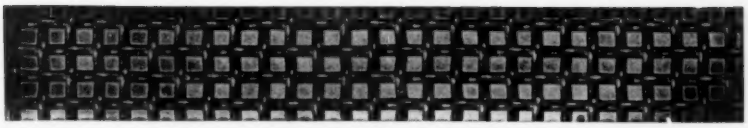
INTERNATIONAL

being developed by **St. Joseph Lead Company.**

HAITI—**Behre Dolbear & Company,** mining, geological and metallurgical consultants, have been conducting a mineral reconnaissance in Haiti. Representing the company were Parke A. Hodges, vice president, Douglas D. Donald, and Allan M. Short.

MEXICO—**Texas International Sulphur Company's** operating subsidiary, **Central Minera S.A.,** has gone into production at its sulphur property near Texistepec. The firm reports it has proven reserves in excess of 5,000,000 tons on 130 acres, and still has to explore the majority of its 123,000-acre concession. A steady output of 9,000 tons per month is now being maintained.

BOLIVIA—A West German Geological Mission is undertaking a survey of the mineral wealth of Bolivia. Members of the team will visit various parts of the country over the next few months, and when the rainy season begins in December they will then begin to assemble all information and prepare illustrative maps and charts. The Mission will systematically visit all mines under the control of the **Corporacion Minera de Bolivia,** the **Mineria Mediana,** and the **Banco Minero de Bolivia.** They will examine the silver, lead, and copper deposits at Colquechaca; tungsten in Rosario; iron in El Mutum; and such regions as Huari Huari and Chacarilla, Tipuani, and San Jose de Oruro e Itos.



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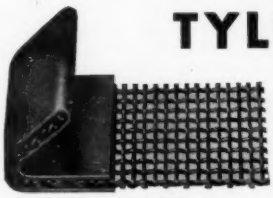

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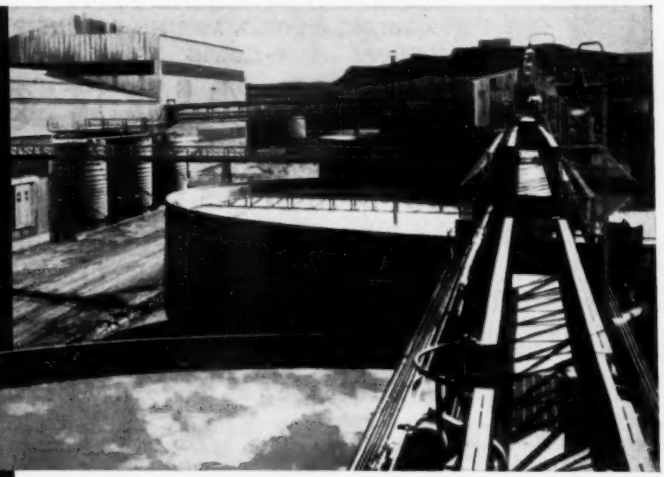

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PERU—Several mining companies are undertaking development work on various Peruvian deposits. **Sindicato Minero Pacococha, S.A.** is developing its silver-lead mine in Pituranga Gully, Pacococha district, San Mateo. **Negociacion Minera y Metalurgica Lizandro Proano S.A.** has started work on the silver-lead mine in the Huamanripayoc Hill of the same district. **Compania Administradora de Minas S.A.** has started to develop several of its copper mines in the Ajoyana and Antauta districts, of the province of Melgar and Carabaya, respectively.

ARGENTINA—Operations in the **Nelly** vanadium mine of San Luis Province are continuing, despite the fact that the average grade is low (0.82 percent V_2O_5). The width of the vein (up to 2 to 3 meters), the recovery of the plant (85 percent), and the low cost of the ore mined make it possible to develop economically. A reserve of 22,500 tons has been estimated which will permit enlargement of the chemical plant for a production of 1,000 kilograms of V_2O_5 concentrate per month.

MEXICO—Scheduled to go into production around the first of the year is **Zinc Industrial, S.A.,** a new company formed by the **American Smelting and Refining Company** and a group of Mexican partners. Located at Tlalnepantla, near Mexico City, the plant will be Mexico's first high-grade zinc producer. Initially, refining facilities will consist of a vertical fractionating column, using western grade zinc from Asarco's Rosita smelter in the state of Coahuila.

VENEZUELA—The government has set aside the Roscio district of the state of Bolivar until January 1961 as a national reserve zone for mining of tungsten. For several years the abandoned **Botanamo** gold mine in the El Callao region has been known to contain some scheelite in its tailings. (Some 300,000 metric tons with an average content of 0.25 percent WO_3 were estimated.) Within the past year, however, state geologists have found more evidence of the mineral in the area. They are now investigating a shear zone and quartz veins which run through the volcanic andesites of the Venezuelan Guiana precambrian shield.

ARGENTINA—A combine known as **Compania Minera de Aceros Cruz del Sur** is said to have submitted proposals to the Argentine government for a $150,000,000 investment in an iron and steel project. Former United States Attorney General Herbert Brownell represented the American-Argentine group which is interested in developing iron ore deposits in the Sierras Grandes area of Patagonia in southern Argentina.

QUEENSLAND—Bauxite deposits at Weipa, Cape York, are now believed to total more than 1,000,000,000 tons. The following developments are now under active study: a survey of New Guinea's hydroelectric potential with a view to constructing a hydroelectric plant, a harbor, and a processing plant near Port

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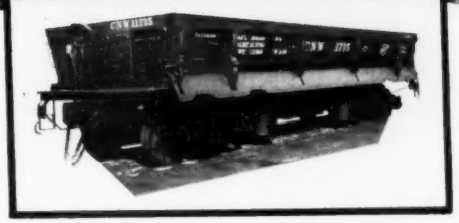

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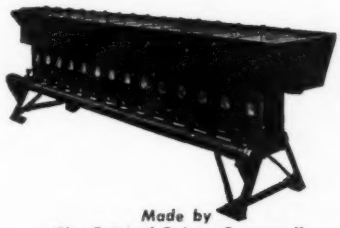

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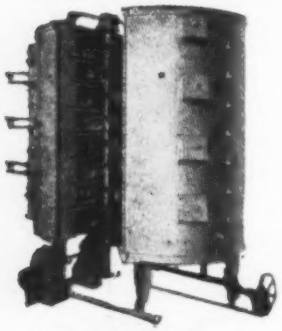

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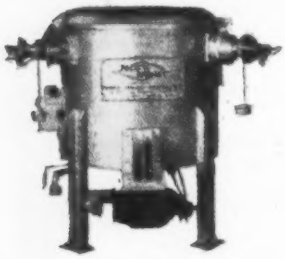

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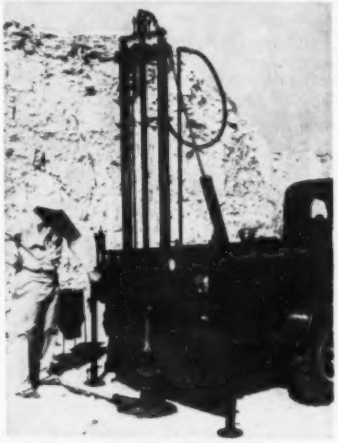

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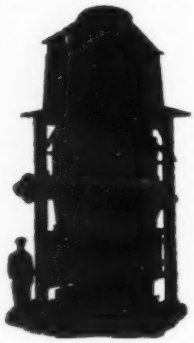

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Moresby; a design by Dutch experts for an all-weather port to handle large ocean-going vessels at Albatross Bay, Weipa; an investigation of water sources for **Commonwealth Aluminum Corporation's** alumina plant and the planned Weipa township.

REPUBLIC OF THE PHILIPPINES—Molybdenite concentrate was produced for the first time in the islands by the **Marinduque Iron Mines** from its **Sipalay** copper mine. The concentrate was a by-product from the company's copper production; 33.235 dry metric tons, equivalent to 36.635 dry short tons, were produced. The company considers this especially significant since molybdenum is worth three to four times the value of copper.

NEW SOUTH WALES—The £8,000,000 zinc smelter project of **Sulphide Corporation Ltd.** (subsidiary of **Consolidated Zinc Corporation Ltd.**) at Cockle Creek near Newcastle is expected to go into operation in 1961. Key to the plant will be the sintering machine and Improved Vertical Furnace. A contract worth between £1,000,000 and £2,000,000 has been awarded to **Simon-Carves Ltd.** for the sinter plant.

REPUBLIC OF THE PHILIPPINES—**Palawan Quicksilver Mines** treated 5,846 tons of ore at its mine in Tagburos, on Palawan Island, in June to produce 25,460 pounds of mercury. This was about 10 percent higher than in May, reflecting better grade of ore milled. Exploration of the mine by diamond drilling is continuing, and prospecting of adjacent claims is also underway. Geologists from Japan have been making studies of the geology of the mine and surrounding district. All of the mercury output goes to Japanese buyers.

NORTHERN TERRITORY—Uranium oxide production by **United Uranium N.L.** at South Alligator River is exceeding expectations. The treatment plant, located at Pine Creek, began operations on May 4th and to June 16th had produced £136,165 worth of oxide. Grade of oxide and mill recovery have been better than expected and reagent consumption has been slightly below expectations. The first shipment of oxide left Darwin for Great Britain on June 27th. The company has been awarded £8,000 by the Federal government for its discovery of El Sherana ore body. Exploration of the **Palette** and **Scinto** leases nearby has just been resumed.

NORTHERN TERRITORY—With the completion of the new sintering plant of **Electrolytic Refining & Smelting Company of Australia Pty Ltd.** at Port Kembla, New South Wales, increasing tonnages of copper concentrates are expected to be sent there from the Northern Territory for smelting. **Peko Mines N.L.** at Tennant Creek is already sending part of its output there, and the remainder to Japan. **Territory Enterprises Pty. Ltd's** Rum Jungle concentrates are currently going to Japan. It is believed that most of the Rum Jungle material (which is obtained from the treatment of stockpiled uranium ore) will be sent to Port Kembla in the coming year, and that a larger tonnage from Peko will also be sent there. This means that, with the addition of extra smelter capacity at Mt Isa and additional refining capacity at Townsville, Australia will shortly be in a position to smelt and refine all copper of domestic origin.

REPUBLIC OF THE PHILIPPINES—**Balatoc Mining Company** has gone out of the mining business and is now an industrial corporation.

NEW SOUTH WALES—**Broken Hill South** now expects that the life of the **South** mine, which for some time had been estimated to have only about eight years of reserves ahead, will now be of much longer duration. Diamond drilling indicates that payable ore shoots exist on the western flank of the anticline, quite apart from ore bodies worked in the past. While not as wide as the very wide lodes worked to date, mining costs may be lower than for the main part of the mine. Also, apart from these discoveries, there are appreciably larger reserves in the main ore bodies than previously believed. Geological and geophysical examinations in progress outside the present lease area have also disclosed three locations of potential interest. The largest structure is south-west of the main lode while two others are to the north.

INDONESIA—Jogjacarta Government Mining is due to start rehabilitation of

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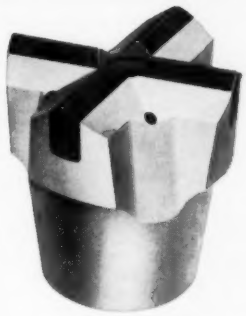

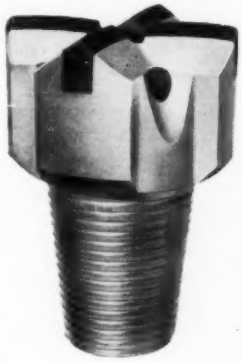

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the manganese ore mines in Kliripan and Penggung.

NEW ZEALAND—**New Zealand Development Corporation,** which has plans for the development of the company's iron sand deposits, has been told by the Prime Minister that the overwhelming measure of advice received by the government shows that a New Zealand iron and steel industry is economically impracticable. Until this point has been disproved, the government will not allow any single organization exclusive right to the development of iron sands.

REPUBLIC OF THE PHILIPPINES—**United Gypsum & Minerals Inc.** has been organized to mine gypsum for cement manufacture. Initial mining operations are underway on the island of Negros.

UNION OF SOUTH AFRICA—According to an agreement between **South African Railways** and **South African Manganese Ltd.,** the former will build and operate a 40-mile extension of the railroad from Sishen to a new terminal at Hotazel, in the Kuruman district. Manganese and iron ores will be the main traffic of the extension, which will cost about £1,232,000 to build. The agreement is subject to ratification by Parliament.

LIBERIA—The Liberian Republic has signed a franchise agreement with the **Gewerkschaft Exploration Company** of Dusseldorf, formed in 1953 by a syndicate of 10 Ruhr mills to prospect, and possibly contract for, mineable iron and manganese ore deposits. Liberia, a republic founded 112 years ago, has been free of the political troubles of the former North African colonies, a fact that is believed to augur well for the future development of its rich ore deposits.

FEDERATION OF RHODESIA & NYASALAND—**The Rhodesian Selection Trust** group of companies is cutting production for the July through December 1959 period by approximately 10 percent of its January through June rate. Based on recent statistics for total Rhodesian production, the curtailment is estimated at about 2,000 long tons per month.

GHANA—The Volta River hydroelectic and aluminum project, originally drawn up under the British administration in Ghana, may go ahead in a modified form if present discussions are successful. **Kaiser** interests are at present holding talks with a number of companies concerning construction work for the plan. Parkinson Howard, in association with Sir Lindsay Parkinson and John Howard, has already been awarded the contract for access roads for the Volta preliminary operations, with a Kaiser affiliate as the employing authority. At the same time, **Aluminum Limited of Canada** has been discussing the aluminum side of the Volta project. It is believed that negotiations are under way for the formation of a firm to undertake the work.

UGANDA—**Kilembe Mines Ltd.** produced 5,539 long tons of blister copper in the first half of 1959. The company has improved its oxide ore treatment method and expects higher output in the second half of the year. In addition, a backlog of 725 long tons, accumulated as copper concentrates in advance of construction of the smelter, will be smelted during the remaining months. Estimated net profit for the first six months is $577,000.

FEDERATION OF RHODESIA AND NYASALAND—With production resumed last April per schedule, **Bancroft Mines Limited** produced 12,166 long tons of blister copper. In June, the company milled 112,399 short tons, in accordance with plans to increase the milling rate gradually to 150,000 short tons per month in the last quarter of 1959.

SOUTH WEST AFRICA—**South African Minerals Corporation** continued its exploratory development operations during the second quarter of this year. Production of manganese ore, made available by the development work, increased during this quarter to 12,314 long tons, compared with 8,811 long tons in the first quarter.

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EGYPT—The **Abu Ghalaga** ilmenite deposit reportedly is being developed, with production scheduled to begin in 1960. Machinery is being imported, and construction work is proceeding at the mine.

MOZAMBIQUE—A new concession has been awarded to **Monteminas Ltd.** in the Alto Ligonha area. The firm will probably mine beryllium ore since it produced 35,250 kilograms of beryl in the first quarter of this year. Also, **Empresa Mineira do Alto Ligonha,** the country's largest beryl producer in the first quarter of the year with 91,453 kilograms, operates in the northern part of Alto Ligonha district. The latter also produced 1,619 kilograms of columbite in the first three months of the year.

UNION OF SOUTH AFRICA—**Middle Witwatersrand (Western Areas) Ltd.,** now engaged in an extended exploration program, has expanded its option area considerably. Together with other interests, an area of about 325,728 claims has been placed under option to the northwest of Bloemfontein and in the Bloemfontein, Brandfort, Boshof and Bultfontein districts of the Free State; and options over another area northwest of the Odendaalsrus Sand River goldfield through the Odendaalsrus and Wesselbron districts into the Wolmaransstad district of the western Transvaal. About 115,776 claims have been placed under option contracts. Drilling, not yet declared conclusive, has been continued in the option area of about 23,472 claims east of the Hartebeestfontein and Buffelsfontein mines in the Klerksdorp area. In the northern Transvaal, mineral rights over 240,829 acres are held, mainly situated in the Pietersburg, Potgietersrust, Waterberg, and Zoutpansberg districts. In the northeastern Transvaal, in the Letaba area, copper and zinc mining operation remain on a caretaking basis, but the subsidiary company concerned has commissioned a pilot plant in which test runs are being conducted to determine whether the ore can be economically mined in large-scale operations.

MOZAMBIQUE—The government has cancelled the concessions of **Sociedade Boliden de Mocambique** and Ace Viking Lillas' **Companhia Mineira Lillas.** The latter held sole rights to all minerals except uranium and thorium in an area of the Tete district, running roughly from the Bambezi, along the meridian of the town of Tete, on the northern side of the river, to the road from Tete to Nyasaland, and from there to the border. Sociedad Boliden had sole rights to all minerals except those that were radioactive. Its concession covered an area running south from the railway line between Beira and Salisbury, roughly from Gondola to the Sava River, and between this line and the Rhodesian border.

FEDERATION OF RHODESIA & NYASALAND—The Seventh Commonwealth Mining and Metallurgical Congress will be held in 1961. Arrangements are already under way to have the delegates convene in the Union of South Africa, fly on to Northern Rhodesia a few weeks later, and then finish the meeting in Southern Rhodesia. A meeting was held in Salisbury under the chairmanship of Sir Ronald Prain to unify the arrangements in the three countries.

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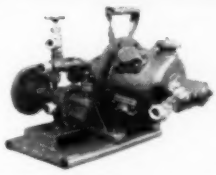

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20—20 cu. ft. C.S. Card, Z20, 18" ga.
11—30 cu. ft. C.S. Card, Rockerdump, 24" ga
32—33 cu. ft. Ajax Type, 18" ga.
25—60 cu. ft. C.S. Card, Granby, 30" ga.
32—37½ cu. ft. Ajax Type, 18" ga.
14—84 cu. ft. C.S. Card, Granby, 30" ga.
5—85 cu. ft. C.S. Card, Granby, 30" ga.
8—93 cu. ft. C.S. Card, Granby, 24" ga.
7—100 cu. ft. C.S. Card, Side Dump, 30" ga.
14—130 cu. ft. C.S. Card, Granby, 30" ga.

JAW CRUSHERS
1—8" x 10" Denver, Type H, New
1—8" x 24" Union Iron Works, 30 HP Motor
1—15" x 36" Universal, 50 HP. G. E. Motor
1—8" x 16" Cedar Rapids, Less Motor
1—Allis Chalmers, 16" Crusher

CRUSHING PLANT
1—Pioneer, Model 40V, Portable, Complete

ENGINES, DIESEL
1—GMC, Model 671 RC, Elec. Start, PTO, 150 HP
1—Duetz, air cooled, Type A12L614, PTO., Excellent

ENGINEERING SUPPLIES
1—C. L. Berger Engineering Transit, 5" Circle, 11" Telescope, 3½" Compass

93 cu. ft. CARD MINE CAR, 24" GAUGE
1—Lietz Alidade Plane Table, 9½" Compass, Excellent Map Tables, Level Rods, Chains, Mechanical Drawing Machines.

FLOTATION MACHINES
1—1 cell Wemco, 44", 5 HP Motor
1—1 cell Denver, #18 Sp. 32" 3 HP Motor
4—2 cell Galigher, 48", 15 HP Motor
1—2 cell Denver, #21, 38" x 38"
10—2 cell Fagregren, 56" x 56", 14 S.
1—5 cell Wemco, 44", 5 HP Motors
1—5 cell Denver, #18 Sp. 32", 7½ HP
2—3 cell Fagregren 56" x 56", 14S.

GENERATORS, DIESEL
1—75 KW Caterpillar D 13,000 220/440 Volt. Diesel

HOISTS, SLUSHERS & TUGGERS
11—15 NNIG Ingersoll Rand, 2 drum, 220/440 V.
2—AAF212 Sullivan, 2 drum, 15 H.P. 220/440 V.
1—C-111 Sullivan, 1 drum 40 HP, 220/440 V.
1—30 MNM 3D Ingersoll Rand, 3 drum, 30 HP, 220/440 V.
2—CF211 Sullivan, 2 drum, 50 HP, 440 V.
3—FF211 Joy, 2 drum, air
4—A4NNU, Ingersoll Rand, 2 drum air
4—HKE Gardner Denver, 2 drum, air
1—K4U Ingersoll Rand, 1 drum, air 3000#
5—HK Gardner Denver, 1 drum, air, 2000#
7—HU, Ingersoll Rand, 1 drum, air, 2000#

HOISTS, MINE SHAFT
1—40 HP Coeur d' Alene Single Drum, Excellent
1—75 HP Puget Sound Single Drum
1—600 HP Vulcan Double Drum, 2300 V
1—500 HP Nordberg Double Drum, 22000# pull, 2300 V.
1—150 HP Vulcan Single Drum, 24,000# FPM, 440 V.
1—400 HP CIR Double Drum, 20,000# at 1200 FPM.

LOCOMOTIVES
16—1½ Ton Mancha Battery, 18-24" ga.
3—1½ Ton Atlas, Type J, Battery, 18" ga.
1—2½-3 Ton Jeffrey, 18" ga.
1—3½ Ton Mancha Titan AX, 18" ga.
3—Universal Tramaire, Air, 18"-24" ga.

MUCKING MACHINES
2—12B Eimco, 24" ga. High or Low Decks
16—G09 Gardner-Denver 18"-24" ga.
1—HL3 Sullivan, 18" ga.
3—12B Eimco, 18" ga. Std. Decks
1—Eimco, Model 21, Mucking Machines, 18" ga.

MILLS
1—Complete Plant, 450 Ton Flotation, Complete w/ steel bldgs.

MILLS, ROD & BALL
1—3' x 8' Hendy Rod Mill, 30 HP
1—6' x 4' Denver Ball Mill, 100 HP
1—64½ Marcy Ball Mill, 100 HP
1—4' x 5' Colorado Iron Works, 30 HP
3—5' x 14' Marcy Ball Mill, 100 HP
1—6' x 16" Hardinge Conical Ball Mill, 50 HP
5—8' x 9' Traylor Ball Mills, 250 HP
1—5' x 8' Traylor Rod Mill, 150 HP

MOTORS, ELEC.
1—200 HP Westinghouse, Ind., 440 V, 580 RPM
1—200 HP G.E. Slip Ring Ind., 2200 V, 585 RPM
1—250 HP G.E. Slip Ring Ind., 2200 V, 585 RPM
2—300 HP G.E. Slip Ring Ind., 550 V, 514 RPM
2—375 HP G.E. Slip Ring Ind., 2200 V, 450 RPM

PUMPS
1—2" Oliver United Filters Centrifugal, 2" Suction
1—3" Byron Jackson, Centrifugal Water Pump, 40 HP, 440 V
1—6" Weinman Centrifugal, 1000 GPM. 140' Head, 100 HP, 440 V
3—Allen Sherman Hoff Hydroseal Sand Pump, 4"
1—Ash Hydroseal Sand Pump, Rubber Lines 2"
1—Denver Vertical Centrifugal Sand Pump, 1½"

WAGON DRILLS
11—FM2 Ingersoll Rand Wagon Drills, 8'
1—Model LM-57-LW-6A, Joy Wagon Drill, 6' Change

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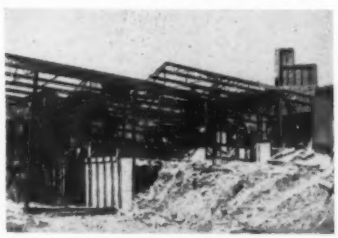

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1—Gardner-Denver 4-Drill Jumbo w/ D93 Drifters, 24" Ga.
90—Ft. 8'6" Horeshoe All-Steel Concrete Tunnel Forms.
1—No. 40-H Eimco Mucker, 36/24" Ga.
4—No. 21 Eimco Muckers, 24/36" Ga.
4—No. 12-B Eimco Muckers, 18/24" Ga.
1—GD-9 Gardner-Denver Mucker, 18" Ga.
1—GD-10 Gardner-Denver Mucker, 18/24" Ga.
1—2-Ton Greensburg Battery Loco., 18/24" Ga.
1—4½-Ton Atlas Battery Loco., 24" Ga.
1—5-Ton G.E. Battery Loco., 36" Ga.
1—6-Ton Goodman Battery Loco., 36" Ga.
4—8-Ton Atlas Battery Loco., 36" Ga.
3—Z-18 Card Cars, 18" Ga.
5—Z-20 Card Cars, 18" Ga.
60—27 Cu. Ft. Koppel Rocker Cars, 24" Ga.
12—31 Cu. Ft. Card Rocker Cars, 24" Ga.
11—4 Cu. Yd. Western Air Dump Cars, 24" Ga.
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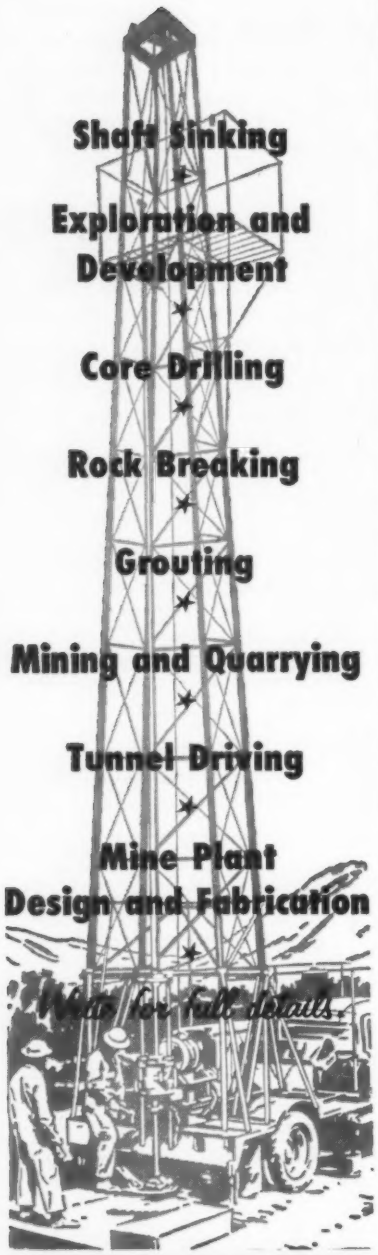

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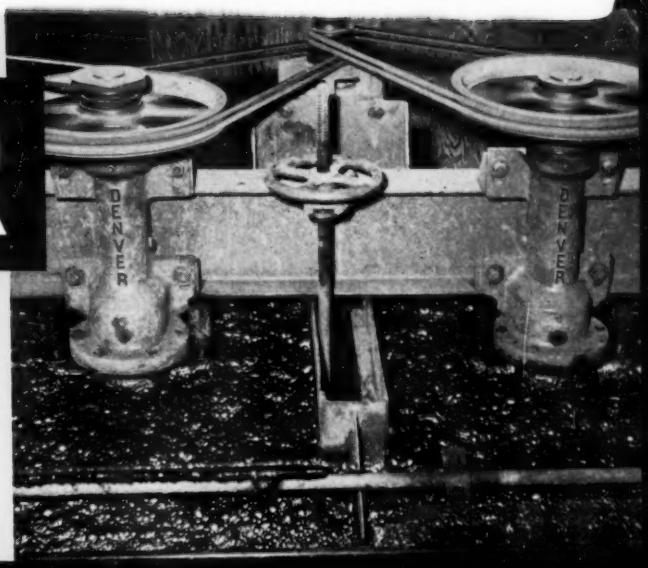

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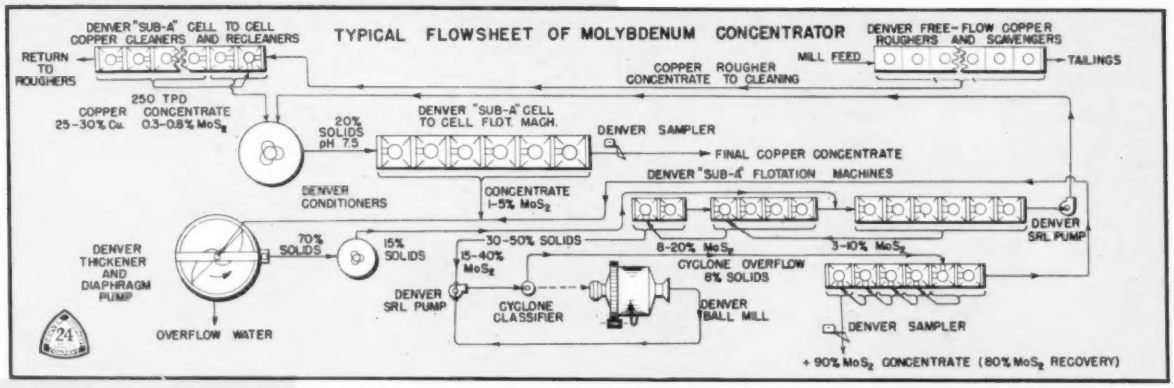

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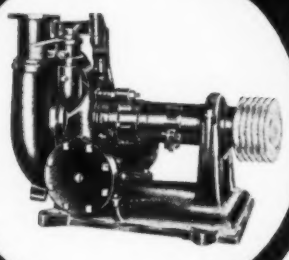

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